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# Quality of Life Assessment after Severe Hand Injury

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*Für meine Großeltern,*

*deren Güte und Liebe*

*mich für immer begleiten wird*

# I Introduction

## I.1 Quality of Life

### I.1.1 Historical Overview

Although the term quality of life was first used in the 20th century, the concept has slowly evolved over time. The idea `quality of life` dates back to the philosophers of the ancient world, who illustrated in their writing that man consisted of both mind and body. (Brown, 1996, p 201) Concepts such as `well being` and `happiness` were contemplated. The term `good life` was used by both, Plato and Aristotle (4thcentury BC), to describe an internal as well as an external state of living for a given individual or segment of the population. Plato regarded `the good life` as `when the person is in harmony with the `good`, with the just order for the soul, state and world`. (Meier, 1995, p 43) For Aristotle, certain favourable external conditions were necessary, so that man could live a `good life` (`eudaimonia`). (Knopf, 2004, p 15) In the first century after Christ, Seneca wrote his philosophical essay on the `happy life` (`de vita beata`; Seneca, AD 62). The `good life` for Seneca and other Stoic`s consisted of the basic necessities for survival which nature provided.

In more recent times, quality of life has received much emphasis in politics. In the American constitution, quality of life was highlighted with the phrase `pursuit of happiness` as an elementary component of freedom and liberty. (Declaration of Independence, In Congress, July 4, 1776) The term quality of life was first mentioned by Pigou in 1920, a British economist, in a book about economics and welfare (Pigou, 1920, p 14), where he discussed government support for the poor in terms of personal well being and the national dividend. It failed, however, to strike a responsive chord and the term disappeared until after the Second World War. At about that time two events occurred: First, the World Health Organization broadened the definition of health to include physical, emotional, and social well being. (WHO - Constitution, 1948, p 2; WHO - Handbook, 1952, p 3) Second, the social inequalities across Western societies became widely acknowledged, giving rise to the social movements and policy initiatives of the 1960s. (Albrecht, 1994, p 11) In Germany, in 1967, the term quality of life was used for the first time by Willy Brandt in a speech. He stated that the quality of life of citizens is the main goal of a social state. (Bullinger, 1997, p 76; Glatzer, 1992, p 52; Illhardt, 1992, p 524)

However, in the 17th edition of the `Großer Brockhaus` from 1970, the term quality of life was still not included. In the encyclopaedia of 1990 the term finally appears as

one of six signal words with the same starting letter. One can find here a `satisfaction scale`, which lists besides marriage, partnership and environmental protection also life standard and health. (Großer Brockhaus, 1990, p 180)

In the field of Social Science, intercultural studies took place to explore quality of life in different countries. Campbell`s study on the `Quality of American Life`, undertaken in 1971, looked at quality of life from an individual`s perspective with participants stating their life satisfaction. Quality of work, family and leisure life in the American context was examined. (Albrecht, 1994, p 11; Bullinger, 1997, p 77; Prutkin, 2002, p 11) At around the same time, Glatzer examined the quality of life in Germany. (Glatzer, 1984, p 391) Newer studies were undertaken by Henrich.

Here, the psychological construct `life satisfaction` was examined as a subjective component of quality of life. (Henrich, 1992, p 31)

Health related quality of life (HRQL) was first mentioned in the medical literature in 1966 by Elkington, who wrote a thoughtful editorial entitled `Medicine and Quality of Life`. He addressed issues about the responsibilities of the medical field in this domain. (Elkington, 1966, p 711) In his article about medical care, written in 1967, White formulated his five `Ds` in an attempt to show how patients can perceive quality of life in a negative manner (Discomfort - for subjective perception; Dissatisfaction - for dissatisfaction with the treatment; Disability - for impairment of physical abilities; Disease - for illness in the broadest sense; Death - for the endpoint and also possibly for the final despair). (White, 1967, p 850) In 1977, quality of life became a key word in the Medical Subject of the US National Library of Medicine MEDLINE Computer Search System. Between 1966 and 1974 there were 40 references relating to quality of life and between 1986 and 1994 over ten thousand were reported. (Albrecht, 1994, p 12) This demonstrates the exponential increase in health related quality of life assessment in medical research. Since that time, quality of life has focused more on the health aspects of personal experiences and emotions. The concept of health related quality of life was born. Bullinger explains that quality of life research evolved from the 1970s to the 1990s through three phases: Firstly, the emphasis was to clarify the nature of quality of life. Secondly, instruments for assessment of quality of life were developed and finally, this was put into practice in different clinical studies. (Bullinger, 1997, p 77) Probst emphasized the importance of assessing quality of life according to the view of each era, as the conditions within each time period determines the characteristics of life circumstances. (Probst, 1992, p 115) In the 21$^{st}$ century, quality of life has become a central concept in all aspects of health care.

### I.1.2 Definition and Concept of Quality of Life

How should `quality of life` be defined? The preacher Salomo gives us an answer: "There is nothing better, than when a person is happy with work; then this is his part." (Salomo, 3,22; p 643)

Current literature reveals the concept of quality of life to be far more complex. No obligatory definition of the terms quality of life and health related quality of life exists. There is a fine line between such terms and related concepts such as `well being` and `happiness`. Schumacher explained health related quality of life as a latent construct, which cannot be observed directly, but can be indirectly approached via indicators (of emotional status, physical complaints and pains, physical ability, social interactions, cognitive function, and life satisfaction). (Schumacher 2003, p 5) Patrick agrees and subdivided the concept of health related quality of life into four groups:

1. Disease related physical complaints, which are regarded by many patients as the primary cause for the impairment of their quality of life.
2. The psychological condition in the sense of emotional status, general well being and life satisfaction.
3. Disease related functional impairments in every day situations like profession, household and spare time.
4. The design of inter - personal relationships and social interactions as well as disease related impairments in this field. (Patrick, 1988, p 14)

Bullinger distinguishes three types of models of quality of life. (Bullinger 1997, p 77) The first model sees the individual in the centre. It explains that only an individual description of quality of life is possible as quality of life varies from person to person with regards to its dimensions. The second model states that quality of life can be described with the help of a certain number of dimensions which are relevant to different people. The third sees quality of life as a construct which cannot be measured either intra - individually or between different people.

One has to differentiate objective and subjective aspects when assessing quality of life. To the objective points of view belong the life and environmental conditions of a person, cultural background and status in society, as well as objective health status. The subjective perspective of quality of life includes the individual evaluation of different life parts and the human life as a unit. (Meier 1997, p 321)

Bullinger described the term quality of life from different aspects:

Clinical norm: Quality of life is high, when a person experiences the least possible impairment and disability during treatment. Social norm: Quality of life is high, when a person functions according to his / her social role and experiences satisfaction

because of that. Individual norm: Quality of life is high, when hopes and expectations are fulfilled in personal experience. (Bullinger 1991, p 144)

Consensus exists today, that the multi - dimensionality of quality of life needs to be considered when assessing health related quality of life. (Bullinger 1991, p 144; Spilker, 1996, p 2; Meier, 1997, p 321) Meier noted that the following dimensions each play an important part for the evaluation of quality of life:

1. Psychological (E.g. fear, depression, well being).
2. Physical (E.g. health status, complaints, disease and treatment related symptoms).
3. Ability to function: Ability to fulfil activities which are connected with the person`s social role (Self - care, mobility, profession, household, spare time).
4. Social (The number, value, and maintenance of relationships to family and friends).

In addition, Spilker includes two further domains, i.e. economic factors and the spiritual - religious status. All the domains are seen as distinct areas that are influenced by a person`s experiences, beliefs, expectations, and perceptions. (Testa, 1996, p 835)

Spilker illustrates the quality of life schematically, consisting of three levels:

- Overall assessment of well being.
- Broad domains (i.e. physical, psychological, social, economic, spiritual).
- Components of each domain.

This 3 - level model shows a generally accepted basic approach. The top level, the overall assessment of well being, describes an individual`s overall satisfaction with life and one`s general sense of personal well being. The middle level describes the broad domains of quality of life. The number and identity of quality of life domains vary among authors. The third and lower level includes all components of each domain that are assessed by quality of life tests and scales. For example, to the components of the psychological domain belong anxiety, depression and cognition. (Spilker 1996, p 2)

Each of these domains can be measured in two dimensions: objective assessments of functioning or health status, and more subjective perceptions of health. Although the objective dimension is important in defining a patient`s degree of health, the patient`s subjective perceptions and expectations translate that objective assessment into the actual quality of life experienced. (Glatzer, 1984 p 392) There are great inter - and intra - individual differences in the perception and evaluation of objective aspects of life or disease. (Henrich, 2000, p 150)

Experts agree that an operational definition is necessary and they generally concur on the components that should be included.
In the author`s opinion, the WHOQOL - Group, and Patrick provide two suitable examples of such a definition and its component parts:
` Quality of life is defined as individuals` perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations and standards and concerns. It is a broad ranging concept affected in a complex way by the person`s physical health, psychological state, level of independence, social relationships, and their relationship to salient features of their environment.` (WHOQOL - Group, 1993b, p 1; Bowling, 2001, p 6)
` Health related quality of life is the value assigned to duration of life as modified by the impairments, functional states, perceptions and social opportunities that are influenced by disease, injury, treatment, or policy. (Patrick, 1993, p 22)

### I.1.3 Importance of Assessment of Quality of Life

An adage of ancient Greek medicine states “help your patients to die young, as late as possible. That is what every physician wants for every one of his patients old or young - not just the absence of death but life with the vibrant quality that one associates with the vigour of youth”. (Elkington, 1966, p 713)
Since 1948, when the WHO defined health as being not only the absence of disease and infirmity, but also the presence of physical, mental, and social well being (WHO - Constitution, 1948, p 2; WHO - Handbook, 1952, p 3), quality of life issues have become steadily more important in health care practice and research. Assessment of the effectiveness of care is undergoing continual change. Treatment options are no longer being judged simply in terms of morbidity and mortality. Instead, interventions are evaluated by studying their impacts on long - term functioning, well being, and quality of life. This new emphasis on measurement of outcomes from the `patient`s viewpoint` (Szabo, 2001, p 993) is of particular interest to plastic surgeons. Aesthetic and reconstructive procedures usually do not produce life saving results. Instead, plastic surgeons endeavour to bestow more subtle benefits on their patients, improving their body image, psychological well being, and physical functioning. Some of the greatest progresses in the medical field and most of those in hand surgery have nothing to do with duration of life (quantity of life), but contribute with major impact to the productivity, adjustment, and satisfaction of patients (quality of life). (Chase, 1983, p 648)

“Surgery of the hand is a demanding and very difficult art.” (Grant, 1980, p 418) Most surgery on the hand is to improve the use of the hand and is not a life prolonging measure. With people living longer, chronic diseases are increasingly a part of life. Medical and surgical progress is leading to ever more expensive care. Before health costs became a growing burden, governments and providers developed services according to what medical experts deemed necessary. They decided, what was good for the nation`s health. Science, objectivity and technology dominated their values and perspective. This traditional system of health care delivery has been undergoing substantial re - assessment and change. Over the last two decades, more emphasis was placed on what works in medicine and on learning how `to make clinical decisions that reflect more truly the needs and wants of individual patients`. (Wennberg, 1990, p 1203) From a surgical perspective, it is essential to examine the clinical relevance of the quality of life concept in terms of indications and types of treatments and quality control. (Goligher, 1987, p 631)

The assessment of health related quality of life has become increasingly important, particularly as an outcome variable in assessing the impact of disease, illness and treatment on the lives of patients. (Wood - Dauphinee, 1999, p 356) The evaluation of quality of life has become a relevant measure of efficacy in clinical trials. Its use is spreading and its importance is growing as a valid indicator of whether or not a medical treatment is beneficial. It can help to improve the quality of patients` treatments and outcomes and may be used to differentiate between two therapies with marginal differences in mortality and morbidity and to compare outcomes between two different treatment modalities, such as replantation versus terminalization after hand injuries. It may also be used to estimate the burden of specific diseases and to compare the impact of different disease on functioning and well being. It may be used for practical and commercial purposes. Quality of life assessment is important for a country`s health planners which can help them to improve the allocation of health care resources.

Highlighting the importance of quality of life studies, Bullinger stated that depending on the aims and the questions that need to be answered, there are different users of life quality research: Firstly, the research results are used in the field of epidemiology, health research and politics in order to derive a description of quality of life in certain population groups. This information is used for health political planning. Secondly, the carrier of medical services (medical aid, pension insurances) and the provider of medical care services are interested in the results of quality of life studies, so that they can assess and value treatments. The third aspect is dealing with the health economic

utilization of quality of life. Here, quality of life is used as a figure in the cost utility calculation with the aim of finding out to what extent the results of extensive treatments are economically and health politically acceptable. (Bullinger, 1997, p 77) The quality of life measure represents the final common pathway of all the physiological, psychological, and social inputs into the therapeutic process. It measures changes in physical, functional, mental, and social health in order to assess the human and financial costs and benefits of new trials and interventions. This patient centred medical care switches attention from medicine to the larger issues of health and wellness. If patients` perceptions and feelings are taken into account in health care decision making, patients will become empowered and more actively engaged in the maintenance and management of their own health. Subjective health assessment represents a value reorientation in research and clinical practice, away from traditional and established research techniques and towards each individual patient. It is an essential foundation for emphasising civility and humanity in medicine by taking patients` perceptions, feelings and problems into account in understanding need and delivering care. At the same time, it is important to realize the limitations of current theory and methods. Appropriate, rigorously designed and evaluated quality of life instruments need to be used in carefully designed studies to provide objective representations of what was viewed until recently as essentially an intangible and subjective process. (Testa, 1996, p 835; Keller, 1996, p 171; Wood - Dauphinee, 1999, p 361)

### I.1.4 Accuracy of Assessment of Quality of Life

The importance of accurately assessing outcome with regard to quality of life is highlighted by the fact that much of what we do for patients is not based on evidence: the so - called `art of medicine`. The assessment of surgical outcome is an essential part of clinical practice. Outcome studies have traditionally focused on measured endpoints, such as grip strength, range of motion of joints, sensory recovery, etc. (Brown, 1996, p 201; Bueno, 2003, p 195) The reason for this is that these tests are repeatable, objective and accurate. It has been said that “measurement is useless if it is not precise and repeatable”. (Brand, 1999, p 322) Such data are called objective, because there is general agreement on how they should be obtained and measured.
A randomized double - blind, placebo - controlled clinical trial is the gold standard for evaluating efficacy in which the primary outcome of interest is usually a clinical end point, such as disease cure. (Amadio, 1997, p 191)

From these studies, doctors have often concluded that the treatment has been successful. The connection between this assessment and a positive outcome in terms of quality of life is easy to make, but not always correct. Improved quality of life is a far more complex issue than good range of motion following joint contracture release for example. Objective tests are not sufficient alone.

It has been shown that the correlation between physician`s and patient`s perception of quality of life using a variety of scales was poor. (Slevin, 1988, p 109) One cannot simply measure adverse reactions or assess clinical benefits of a medical treatment and reach any firm conclusions about how a patient`s quality of life is affected. The benefits and problems are filtered through a patient`s values, beliefs and judgements to determine whether the net change represents a positive or negative effect on overall quality of life. (Watts, 1998, p 489) Studying quality of life needs subjective input from patients to ensure accuracy and to provide a clearer picture of the outcome of care. (Wood - Dauphinee, 1999, p 361) Despite an increasing number of studies suggesting that questionnaires can reflect patient satisfaction more closely (Amadio, 1996, p 786; Choi, 1997, p 611; Levine, 1993, p 1585), papers studying subjective patient input are only now finding their place in the body of scientific literature. Subjective assessments of function have previously been avoided by clinicians, because of the difficulty with measurement accuracy. (Watts, 1998, p 485) There is an attitude that data provided only by the patient is somehow more subject to bias and measurement error than that recorded by a clinician or by a machine. Clearly, clinicians and machines are subject to bias and measurement error, too. The reliability and responsiveness of clinical questionnaires actually can exceed that of many commonly used physical or mechanical tests. Patients are, in general, “just as reliable in telling us what they can and cannot do as they are in showing us what they can and cannot do on physical examination”. (Amadio, 1997, p 192) Furthermore, there is the risk that patients can lie and deliberately exaggerate or suppress the emotional element of their illness (Snaith 2003, p 2), but patients can also give false responses to objective measures like 2 - point discrimination (2 - PD) or grip strength. Patients can be assessed by direct interrogation or via self - assessment tools. The method of administration of a questionnaire can influence the content of answers. It has been previously shown, that patients report more health related problems when completing a questionnaire than when interviewed. (Cook, 1993, p 532; Bergner, 1981, p 787) Sensitive questions about embarrassing symptoms and attitudes may be more readily answered by self - administered questionnaires than by face - to - face interview with strangers. (Wiseman, 1972, p 105)

Considerable problems exist in formation, measurement and interpretation of quality of life. There is no gold standard measure of quality of life. This complicates the selection of an appropriate assessment scale. It is difficult to know if a measure is valid if there is uncertainty about what is supposed to be measured in the first place. (Calman, 1987, p 2; Bullinger, 1991, p 143; Gill, 1994, p 621; Meier, 1997, p 325; Leplege, 1997, p 47)

Problems of quality of life research in surgery include: (Bullinger, 1991, p 146)

1. Conceptual level (models of quality of life and legitimation of research).
2. Methodological level (adequate instruments and statistical analysis).
3. Practical level (strategies for the conduct of quality of life studies).
4. Political level (interpretation and use of study results).

Despite the inherent inaccuracy and problems with quality of life assessment, it has been increasingly recognized that for the medical community to truly assess quality of life outcome, study design must incorporate both subjective and objective components. Current refinements of outcome instruments are helping to achieve the goal of measuring and analyzing the size of the effect of health related quality of life issues. The real challenge, however, is to establish the connection between the diagnosis and treatment of health related quality of life problems. To what degree practical knowledge is gained from quality of life assessment and whether quality of life changes and treatment effects can be interpreted by physicians and surgeons and lead to therapeutic solutions remain to be seen.

## I.2 Severe Hand Injury

### I.2.1 Overview

The hand is one of the most frequently injured parts of the body. (Bueno, 2003, p 193) In 30 - 40 % of injuries the hand is involved. The incidence of hand injuries in the USA has been reported as 5 - 11 per 100 workers per year. (Ultee, 2003, p 457)

The hands provide us with independence and a sense of autonomy. We use our hands for productivity, employability, expression of sexuality, affection, aggression and communication. The hand forms the most frequent point of physical contact between strangers and acquaintances, the hand shake a universal form of greeting. “States of mind are manifested, almost without exception, in the tensions and relaxations of facial muscles…and in the movements of limbs, and in particular of the hands”. (Freud, 1953, p 286) Function and appearance are closely interlinked. No organ in the body has the capacity for motion that the hands have, and this makes man as dependent upon his hands as upon his brain. The hand has been previously described

as a sense organ or an extension of the brain to the environment. In addition to their functional role, the hands are important for the body image. The hand is a symbol for identity, a mirror of the mind and a tool of the soul in the way our personality and psyche is expressed in gestures and movements in the body language. The cosmetic importance of the hand is not to be underestimated. Irrespective of custom and attire, in virtually all societies, the hand is constantly on display and it is as important a cosmetic unit as the face. A disfigured hand is easily observed and evaluated by others, resulting in the individual becoming acutely aware of any associated social stigma. (Kilgore, 1977, p 468; Tamai, 1982, p 550; Lundborg, 1997, p 3; Klapheke, 2000, p 453; Sammut, 2002, p 271)

The ability to play beautiful music on a piano or violin or the ability to perform any similar complex task, represents the hand at its functional peak. Here, the hand is a finely tuned appendage - accurately sensate, delicately mobile, and powerful beyond its appearance. This specialised function is lost after a severe hand injury. Missing and deformed digits, stiffness, pain, lack of sensation and power all combine to reduce the function of the hand. A hand injury can be particularly threatening to an individual who relies upon fine motor skills to perform work related tasks. There is a potential for a hand injury to destroy a career and threaten quality of life. (Chin, 1999, p 62)

After a severe injury to the hand, the function can be so reduced that it works as little more than a clumsy assist limb, if all fingers and thumb have been amputated. If digital length remains but there is no opposable thumb, the hand functions broadly as a sensate hook. It is only with the return of an opposable thumb that prehension (i.e. the ability to reach out and grasp) becomes once again an integral part of the function of the severely injured hand. There is much improvement in function between each of the categories (assist limb, sensate hook, prehensile - organ). There is still, however, a large functional gap between a reconstructed prehensile hand and the normally functioning hand of the piano maestro. It is the aim of the hand surgeon to return the severely injured hand as much as possible to normal again. Current surgical techniques and treatments allow this to be performed better than ever before. Microsurgical replantation, fracture stabilisation, nerve and tendon repair, and soft tissue cover are all possible. Most patients with severe hand injuries require ongoing treatments and multiple operations to optimise their function. Transferring toes to become fingers and fingers to become thumbs are all used when necessary. All of these surgical techniques were used by the surgical team at rechts der Isar Hospital, Munich, in the treatment of this study group of patients.

### I.2.2 Classification of Severe Hand Injuries

As techniques in reconstruction after severe extremity injury were developing, a variety of scoring systems for injured limbs emerged in the trauma literature.
The goal for each of these systems was to establish guidelines for the treatment of mangled extremities and, depending on injury severity, to provide surgeons and patients with some idea of the prognosis of a functional outcome.
In an attempt to use objective measures as predictive indices, several scoring systems have been developed to identify those limbs that are salvageable. These scoring systems include the Mangled Extremity Syndrome Index (MESI) (Gregory, 1985, p 1147), the Predictive Salvage Index (PSI) (Howe, 1987, p 205), the Mangled Extremity Severity Score (MESS) (Johansen, 1990, p 568), and the Limb Salvage Index (Russell, 1991, p 473).
Criticism for these scoring systems includes a lack of agreement as to what should be measured. Although the quality of skin, muscle, bone, and ischemia are variables in all of these scoring systems, vessel injury is addressed in the MESI, PSI, and LSI, whereas nerve injury is included in the MESI and LSI. Other factors such as shock, age, and mechanism of injury are components of the MESI and MESS. An overall injury score, the ISS, and co - morbid conditions are also included in the MESI score. Additionally, these scores were mainly developed for trauma of the lower extremity, not the upper extremity. They do not address the potential functional outcome of the upper limb following the initial injury and the subsequent secondary reconstruction. (Durham, 1996, p 572)
Reconstructive efforts can restore some or most of the function of the hand to a much greater degree than lower extremity reconstruction can restore the function of the foot, ankle, and leg. Whereas a prosthesis is extremely functional in the lower extremity, native functional sensate tissue is irreplaceable in the hand. (Beasley, 1986, p 399; Peacock, 1987, p 157; Rosenthal, 1986, p 579) However, it has previously been argued that amputation of the hand has a place. (Brown, 1979, p 423) Preservation of life comes before preservation of limb. Some authors have concluded that none of these scoring systems were reliable predictors of functional outcome. (Bonanni 1993, p 99; Durham, 1996, p 572) Slaughterback, however, did find the MESS to be an accurate predictor of amputation of the severely injured upper extremity in his retrospective study, but he conceded that the surgeon`s clinical judgement should be the main factor in deciding on amputation or salvage of an injured extremity. (Slauterbeck, 1994, p 284)

There are classifications in the literature that look specifically at the hand. Each of these provides a categorization that is arbitrarily grouped according to the part of the hand predominantly involved. It is imperative that a comprehensive classification system incorporates the degree and precise location of soft tissue and bony injury as well as vascular integrity to the damaged part of the hand.

Campbell classified hand injuries into five groups. These groups are dorsal injuries, palmar injuries, radial hemi - amputation, ulnar hemi - amputation, and distal amputation. (Campbell, 1984, p 3) This classification provides a reasonable basis for the planning of treatment and also gives an insight into the prognosis, because it is based on the relative functional importance of the different rays and surfaces of the hand. There is however no score and therefore the classification is not quantitative. Furthermore, it is not all inclusive. (Saxena, 2004, p 512)

The TIC - TAC - TOE - classification is a descriptive system that divides the hand into nine zones, including the carpus. (Weinzweig, 1997, p 1201) The skeletal damage is weighted too heavily in the author`s opinion and there is no actual score, and therefore it does not offer much more than Campbell`s original classification.

The Hand Injury Severity Scoring System, developed in 1996, is a score specific for hand injuries. (Campbell, 1996, p 295) It assesses all severities of hand injury and gives appropriate weightage to the different rays and surfaces of the hand according to their functional importance. It can compare `like with like` and evaluate most hand injuries. This quantitative scoring system allows the clinician to obtain a total score for the hand injury. This score can be used in conjunction with functional assessments and long - term outcome studies to guide therapy in the acute stage and in rehabilitation. The Hand Injury Severity Scoring System was chosen by the author for use in this study.

### I.2.3 Outcome after Hand Injury

Outcome represents the end product of treatment and provides the ultimate verification of whether the treatment improved the health status of the patient. In a broad sense, the outcome assessment should consider the biological or physical, psychological, and social effects that resulted from treatment. The goal of assessing health outcomes is to improve the quality of care, the quality of health, and thus the quality of life of patients.

Advances in trauma management, skeletal fixation, microsurgery, soft tissue coverage, and antibiotics have salvaged severely injured extremities that would have been amputated in the past. However, the outcome of the initial salvage surgery and

subsequent complex reconstruction may be compromised by the morbidity of multiple surgeries, long hospitalization, family and work issues. All of these can also affect patient compliance. This unpredictable outcome fills the patients with uncertainty about the future, which can lead to demotivation, persisting unemployment, and psychological stresses. (Ultee, 2003, p 458)

The assessment of outcome related to the patient and the success of the rehabilitation process should encompass every aspect of function (Macey, 1993, p 174), calculated from a combination of objective and subjective measures, i.e. movement, power, sensibility, pain, skin resistance, conductance, and sensory threshold measurement, activities of daily living, complications, patient satisfaction. (Huskisson, 1983, p 86; Macey 1995, p 842; Watts, 1998, p 489) The patient`s personality and psyche can also have an impact on the outcome of treatment. (Brown, 1996, p 202)

The limitations of surgery and the prognosis of the final, functional outcome of hand injuries depend not only on the severity and extent of the initial injury, but also on the patient`s background history, i.e. age, underlying health condition, occupation, overall expectations, compliance, and psychological disposition. Each of these factors can be a significant variable in the final functional outcome of severe hand injuries.

Objective measurements represent a significant factor in assessing outcome after hand injuries. However, they must be viewed within the context of the restoration of a functional hand and whether that goal has been achieved.

Many of the earlier outcomes data, addressing severe hand injury, came from studies looking at replantation and revascularisation. Although these series did not concentrate only on `mutilating` hand injuries, they did assess outcome in such a systematic way so that it could be used for most severe injuries of the hand.

A thorough literature review by Bueno looked at previous attempts to combine objective and subjective outcome measures. (Bueno, 2003, p 193) Weiland`s series of replantations demonstrated a uniformly high level of patient satisfaction. (Weiland, 1977, p 7) Chen`s review of replants included the patient`s ability to work, range of motion (ROM), sensation, and muscular power as outcome assessment criteria. (Chen, 1978, p 515) Kleinert`s series of replants incorportated 2 - PD sensibility ratings, grip strength, ROM, absence of cold intolerance and return to work to assess outcome. (Kleinert, 1980, p 396) Tsai`s assessment of functional outcome looked at grip strength, key pinch, 2 - PD and ROM and return to work. (Tsai, 1981, p 326) Each of these authors used objective measures and subjective yet equally as important criteria to assess outcome. Tamai combined objective with subjective data, when he developed a scoring system for replanted or revascularized digits, looking at the

following parameters: ROM, activities of daily living, sensation, subjective symptoms, cosmesis, and patient satisfaction. (Tamai, 1982, p 556)

These were the earliest attempts to incorporate objective with subjective measures in the evaluation of overall hand function. This concept has become increasingly important in the development of outcome measures. More recent improvements in outcome assessment, emphasizing both subjective and objective measures, included: Gorsche`s study of corn picker injuries which looked at the patient`s subjective evaluation of the usefulness of the injured limb. This outcome assessment emphasized the importance of prehension in restoration of hand function. (Gorsche, 1988, p 424) Wei`s review of mutilated digits, reconstructed with foot tissue, revealed a high success rate with regards to sensory recovery, ROM, absence of significant cold intolerance, minimal donor site morbidity, and limited restriction in the patients` activity of daily living. (Wei, 1989, p 656)

Recent literature has emphasized the need for assessing outcome using validated and reliable patient questionnaires so that meaningful conclusions can be drawn regarding treatment and outcome. (Amadio, 2001, p 67; Szabo, 2001 p 995; Meier 1997, p 324) There is no agreement on standards, appropriate measures, or instrument tools to assess more subjective data, such as relief from pain, patient satisfaction and quality of life.

Subjective measures have been criticised in the past, because of variability in patient response and attitudes, lack of reliability and difficulty in validating these measures. It is precisely this data, however, that represents the outcomes that are often the most relevant to the patient. Hand surgeons must address those issues that are most important to patients if they are to be able to provide the most cost - efficient care of the highest quality.

### I.2.4 Psychological Impact of Severe Hand Injury

A severe hand injury may have physical, psychological, social and economical implications with long - term consequences. (Grunert, 1988 b, p 177; Johnson, 1993, p 221; Gilbert, 1996, p 368) Loss or mutilation of the hand gives a blow to the person`s inner image that reverberates through their entire psyche, altering the victim`s whole view of himself and his place in the world. (Kolb, 1959, p 763; Kilgore, 1977, p 471; Cohney, 1978, p 6) This is made worse if the individual has an identity heavily determined by body image. Here, the psychological impact may outweigh the functional loss (Klapheke, 1999, p 163) and although the main goal is to restore function, the appearance of the hands may be of greater psychological

importance to these patients. (Pulvertaft, 1990, p 7) The degree of disability resulting from severe hand injuries is determined by the patient`s perception of the loss, acceptance of the hand, and ability to adapt. (Brown, 1979, p 418; Brown, 1996, p 201) After the patient`s suffering about the loss, he / she must come to terms with `the conflict between body image as perceived and that maintained by the ego as ideal` (Kolb, 1959, p 751), and accept a new body image, a process heavily influenced by personality and environmental factors.

Mutilating hand injuries can be associated with stress and anxiety disorders, major depression, pain syndromes, and adjustment problems. (Mendelson 1986, p 582)

Up to 94 % of individuals with a severe hand injury experience symptoms associated with one of these disorders. Symptoms include: nightmares, flashback memories, mood swings, cognitive difficulties, concerns regarding disfigurement, phantom limb sensation, and fear of dying. Flashbacks and nightmares are by far the most prevalent symptoms immediately following injury and are regarded as one of the core factors contributing to emotional distress in the early stages of traumatic hand injury. (Cohen 1987, p 485; Grunert, 1992, p 539) Flashbacks are regarded as an important predictor of the return to previous work place status. (Grunert, 1988 a, p 127) Anxiety was considered to be the most frequent and persistent symptom post replantation surgery. (Meyer, 2003, p 43) Gustafsson found that problems experienced by patients decreased during the first 3 months post injury, but remained unchanged during the rest of the year. In the 1 - year follow - up, most of patients experienced slight to moderate functional limitations in the hand and 30 % still had symptoms of trauma related distress. This may have long - term implications for the patients` work and life situation. (Gustafsson, 2004, p 986)

Grunert agrees that the psychological impact after severe hand injury is at its worst in the few months following the trauma. He further points out that many patients still have ongoing psychological difficulties 18 months after the injury, e.g. with flashbacks and fears of re - injury persisting in about 40 % of patients. Cosmetic concerns were particularly pronounced in the long - term social acceptability of the injury. All of these symptoms are particularly common in hand - injured patients, because the hand itself frequently becomes part of the stimuli evoking the psychological distress. Patients who have undergone trauma to their hand in the work setting seem to be particularly vulnerable to the development of significant anxiety. Additionally, because the work setting is often a major source of positive satisfaction and social interaction, the traumatic effect is compounded when this source of self - esteem is lost. (Grunert, 1992, p 539)

Pain has been identified as one of the most acutely stressful aspects of traumatic injuries and their treatment and can negatively influence the immediate and long - term functional outcome. (Himmelstein, 1995, p 1282; Miller, 1993, p 116; Miller 1994, p 657) There are different types of pain experienced by patients with severe hand trauma: The acute somatic pain of injury and of any subsequent surgery, the phantom limb sensations and pains following amputation, and the complex regional pain syndromes, which are difficult to diagnose and treat. Acute pain can be well controlled with a variety of medication, but chronic pain is more difficult to alleviate. It gnaws at the soul. The connection between pain and depression (Johnson, 1993, p 225; Miller, 1993, p 116; Walters, 1961 in Bradley, 1963, p 741) as well as pain and post - traumatic stress disorder (PTSD) (Schreiber, 1993, p 109) has been established. There is also evidence that when an individual with a work related upper extremity injury has difficulty coping with pain and loss of functioning, prolonged disability may result. (Himmelstein, 1995, p 1282) At least 90 % of individuals with amputation experience phantom limb sensations, which can be emotionally distressing for the patient. This diminishes to 20 % by 18 months. (Grunert, 1992, p 541) Phantom limb pain, which occurs in more than 80 % of amputations (Krane, 1995, p 21; Sherman, 1983, p 237), has been identified as a potential risk factor for poor adaptation post amputation. (Pell, 1993, p 449; Brown, 1990, p 14) If severe, this will impact negatively on the patient`s quality of life. (Tomeno, 1998, p 207) Pain from a disorder which was previously tolerable may become intolerable if a depressive state supervenes. (Bradley 1963, p 744)

The sub - group of patients with severe hand injury where parts of the hand have suffered traumatic amputation, deserves specific mention.

Amputations cause drastic changes in one`s life. Major occupational, social, and emotional adjustments are needed. (Kashani, 1983, p 256) In addition to experiencing the hand injury as a life threatening event, these patients are typically admitted to the hospital as emergencies, with decisions regarding surgical interventions rapidly occurring. A key issue here is the fact that the decision to terminalize the injured parts or to attempt replantation is made in a rush and often without discussing the long - term benefits and risks with the patient. As a result, there is minimal opportunity for psychological or emotional preparation. The replanted hand or digit may be perceived as foreign or altered because of its appearance or changes in sensation (Schweitzer, 1982, p 278) and it is not unheard of for patients to become extremely unhappy with the functional result - so much so, that they request removal of the replanted digit or hand. (Brown, 1979, p 417) As with other mutilating hand injuries, replant patients

experience significant disruption in body image and bodily integrity. This needs time to adjust to. In those patients that require terminalization, depression can occur in about 30 %. (Rybarczyk, 1995, p 103; Kashani, 1983, p 257)

Hand surgeons are advised to consider the psychological characteristics of the individual before determining that replantation is the most appropriate option. Situations in which replantation may be contraindicated because of psychological issues include self - inflicted amputations or if the individual is insufficiently motivated or is unable to comply with rehabilitative efforts and recommendations. (Kleinert, 1978, p 206; Phelps 1978, p 13; Schweitzer, 1982, p 277)
The involvement of the patient in the replant decision should be encouraged, as patients are more likely to be satisfied with their care when given the opportunity to participate in decision making, which would then lead to more favourable treatment outcomes. (McCabe, 2001, p 351; Tamai, 1982, p 549) A psychological or psychiatric evaluation may provide guidance to the hand surgeon regarding potential factors that would negatively influence the functional outcome of a replantation procedure. (Schweitzer, 1982, p 278)

Following severe or major hand injury, a person`s adaptation evolves over time. The process of developing reasonable hopes for the future involves a balance between limits and possibilities as they are discovered by patients through experience. Adaptation is an evolving longitudinal process that has unique characteristics for each patient. The positive orientation of Batterham`s model (Batterham, 1996, p 1221) is consistent with the WHO`s framework for documenting health status and outcomes of services that now includes body systems, activities, and social participation, called the International Classification of Functioning and Disability and Health (ICF) (WHO 2002, p 9). This framework focuses on the need to examine, rather than assume, the nature of relationships between body systems, activity capabilities, and social participation in real world environmental contexts. (Mac Dermid, 2005, p 298)
Issues, that may influence long - term functional recovery and psychological adjustment following hand injury include: Valued occupations are an important motivating factor. The connections between occupational performance, sense of self, and identity have been previously reviewed. (Christiansen, 1999, p 553) Relationships are a significant source of motivation in the adaptive process. (Mendelson, 1986, p 582) The attribution of responsibility for an injury plays a significant role in adjustment to injury and disability. (Brewin, 1983, p 455; Johnson, 1993, p 226)

Increased sensitivity to a disfigured hand may lead to failure to comply with treatment or avoidance of returning to work. (Miller, 1994, p 656; Meyer 2003, p 41)
Pre - trauma personality inadequacies and presence of psychopathology have been correlated with poorer post injury adaptation and may contribute to stress reactions and susceptibility to stress related conditions. (Johnson 1993, p 224; Whetsell, 1989, p 1158; Hardy, 1988, p 162; Bonica, 1990, p 225) There is a difference of opinion with regard to pursuit of litigation and compensation claims, psychological outcome and time off work. Some believe that patients fail to respond to treatment and stay off work for a longer period when there are litigation and compensation issues involved. (Miller, 1961, p 923; Johns 1981, p 423; Himmelstein, 1995, p 1282, Brown, 1996, p 202) Other authors, however, find that compensation and litigation issues do not play a significant role with regards to psychological outcome. Such problems do also not contribute to a failure to return to work. (Cohen, 1987, p 485; Pfeffer, 1988, p 85; Grunert, 1991, p 1032) Early psychotherapeutic intervention might play a key role in the absence of relationship between litigation, psychological symptom maintenance, and return to work.
It is logical to think that the severity of injury would be the most important factor in the patient`s psychological and occupational adjustment to that injury. However, there is limited correlation between injury severity and these factors. (Beasley, 1981, p 362; Kleinert, 1980, p 394; Lee, 1985, p 494; Beasley, 1986, p 396; Grunert, 1988 a, p 127; Meyer, 2003, p 42) A good example of this is the study of 150 self - employed surgeons, who had lost part of their hands. (Brown, 1982, p 37) 98 % did not complain of functional impairment. Many surgeons reported that there was some surgical advantage to a narrowed hand. None changed their speciality, and almost all said that the loss of part of their hand did not seem to influence their patients` opinion of them. Almost everyone said that motivation was the key to their adaptation. Brown concluded that acceptance, adaptation, and incentive were dominant factors in rehabilitating an injured hand. He further stated that motivation of the patient was more important to hand function than the actual number of digits.
Adjustment following hand injury with amputation has different stages: Functional acceptance is where the hand is retrained in its altered state. This usually comes rather quickly, depending on injury severity, the patient`s motivation, and the complexity of activity attempted. Next is the cosmetic acceptance, where the adjustment patients make to how they see the hand and how they believe others see it. This varies considerably with age, sex, and personality. Last, is emotional acceptance, in which the patient overcomes grieving for the lost part, accepts the loss with some

resignation, and gets on with using the depleted hand in as useful a manner as possible. Such acceptance is probably never complete, as it is natural that all amputees will have regrets over their loss, but it can be considered as practically complete if the patient uses and displays the hand in an uninhibited and productive manner and never uses it as an excuse for lack of achievement. Put another way, patients, who clearly understand that physical impairment (a somatic sate) is not related to disability (an emotional concept), will not see themselves as disabled. Disability is a "state of mind, not a state of fact". (Brown 1982, p 36)

It is not to be denied that the main objective in the treatment of major and severe hand injuries is to restore the maximum functional ability possible, and therefore allow rehabilitation of the patient to his normal occupation in as short as possible time and with the least possible disability. However, the appearance of the repaired hand and its restoration to as near normal as possible is also a significant factor in the very important social rehabilitation of the patient.

There are strategies in which positive adjustment for persons with a mutilating hand injury can be promoted and this should begin as soon after the injury as possible. (Grunert, 1988 b, p 178; Grunert, 1990, p 512) The most important aspect here is to create a realistic picture of acute and long - term goals for the patient and family. (Mendelson, 1986, p 578) There is evidence that early referral of patients to mental health professionals after traumatic injury, can substantially reduce psychological morbidity and facilitate more rapid return to work. (Grunert, 1991, p 1033; Grunert, 1988 b, p 180; Johnson, 1993, p 222) The benefits of conducting psychological assessments of hand injured patients include expressing empathy, obtaining information regarding issues of malingering, establishing pre - injury mental state, helping to clarify treatment issues concerning the hand injury, facilitating psychological intervention, aiding an early return to work, identifying sources of non - compliance and allowing patients the opportunity to tell their stories. (Johnson, 1993, p 221) Initially, one has to find out about the presence of anxiety, flashbacks or nightmares, and fears of death or re - injury. This can help to identify patients, who should be considered for early psychotherapy after severe hand injury. (Grunert, 1992, p 542)

Work related injuries and the occurrence of PTSD may present a particular challenge. One of the cardinal symptoms of PTSD is avoidance of stimuli that remind the individual of the injury. In work related injuries, this avoidance may include the work environment. Many workers fail to return to work because of psychological factors.

Desensitisation with graded work exposure has been applied as a highly successful technique for patients returning to their previous employment. (Grunert 1990, p 513) One has to combine rehabilitation experience with the patients` daily lives, their occupations and relationships that are important aspects of their identity.
The long - term, functional outcome of a mutilating injury can be greatly improved if the hand surgeon adopts a biopsychosocial perspective. (Engel, 1977, p 133)
Modern treatment regimes with improved surgical techniques, advanced pharmacological pain management, early psychotherapeutic input and involvement of patients in decision making for treatment have rehabilitated a higher percentage of patients with severe hand injuries than ever before. When faced with a patient that has sustained a severe hand injury, it is clear, that the treatment required is not only dictated by the anatomical damage to the hand. The patient`s past medical history, pre - injury personality, psychological make - up, social and cultural background, occupation, hobbies, handedness, as well as expertise available, besides other factors all need to be taken into account in order to optimize the quality of life for the patient after severe hand injury in the long - term.

## I.3 Aim of Study

The aim of this study was to investigate the outcome of severe and major hand injuries with specific emphasis on quality of life. With that in mind, it was necessary to reflect a nearly complete picture of the life situation of these patients in order to have a better understanding of the problems that patients with mutilating hand injuries live with.
Central Questions to be addressed were:

1. What connections exist between the severity of the hand injury and the resulting complaints and the quality of life?
2. What is the value of the HISS system in predicting quality of life?
3. Which factors are associated with poorer quality of life after severe and major hand injury?
4. Is it possible to extrapolate findings that affect quality of life in this patient group to a wider hand injury population?
5. Which psychometrical test is best to predict quality of life after hand injury?
6. What is the difference in quality of life of patients who had their amputated fingers terminalized versus replanted?

Steps taken to address these questions:

- In this study, psychological, physical, functional, social and economical aspects in the lives of hand injury patients needed to be investigated.
- The information needed, to evaluate quality of life after severe and major hand injuries, had to include factual data of the hand injury and subsequent treatment, a method of scoring the severity of the injury, and a number of different subjective psychometrical tests which needed to include aspects of psychological, physical, functional, social and economical domains.
- Different psychometrical tests were chosen in order to maximise accuracy in the evaluation of the patient outcome by `triangulation`.
- A method of data collection needed to be used, which can be applied to the individual patient and at the same time allowed scientific analysis in the post-injury period. On the one side, the questionnaire should be easy to understand and allow uncomplicated completion by the patient and on the other side it should facilitate a clear and purposeful analysis. The data, which was provided by the patient, needed to be converted to numerical values in order to aid comprehensive data analysis.
- In this study the task was to design a multi - dimensional assessment tool for the evaluation of health related quality of life of patients after hand injuries in association with the WHO - definition of health. With this definition, the three theoretical main dimensions `physis`, `psychy`, and `social` were described. At the design of the patient questionnaire it was endeavoured to assess the health status of patients with regards to these three main axes as completely as possible. In order to achieve this, the given theoretical main elements were subdivided into further dimensions, e.g. `physis` into function, work, pain and symptoms. With completeness in mind, the new measuring tool needed to include dimensions which were so far not considered as own factorial dimensions with previous measurement instruments, although they seem relevant for the description of health status, like spare time.
- In this study, the term health related quality of life will be used synonym with quality of life.

# II Patients and Methods

## II.1 Patient Group

In this section, it will be explained how the 1952 patient records, that were initially analyzed, led to a final number of 118 patients who were eligible for inclusion in this cross - sectional, quality of life - questionnaire based survey.

The rechts der Isar Hospital records of all severe and major hand injury patients from 1976 until 2003 were analyzed. The year 1976 was simply the first record of a patient with a severe or a major hand injury on the available database. August 2003 was however specifically chosen as an endpoint for patient inclusion. This was to ensure a minimum of 12 months rehabilitation before the questionnaire was filled in by the patients. All patients were treated and operated on at rechts der Isar Hospital, Munich. When studying patients` data, those who had obvious minor injuries to their hands, were immediately excluded. The hospital records of all patients with possible severe or major hand injury were studied. The information obtained from the patient's hospital records included documentation at initial patient assessment, operation details, as well as all subsequent data entered into the patient file. With these facts, a Hand Injury Severity Score (HISS) (Campbell, Kay, 1996) for each patient was calculated. Every patient with a HISS score > 50 was included. Of the 1952 patient records analyzed with reference to the HISS, 934 patients with severe or major hand injuries could be identified. These 934 patients received a rechts der Isar Hospital letter, asking them if they would be willing to take part in this qualitative patient survey. The nature of the study was explained and the patients asked to tick either the `yes`- box, if they wished to participate, or to tick the `no`- box. A stamped addressed envelope was included to facilitate the return of the letter. This was done in an effort to maximise the response. The definitive patient questionnaire had 18 pages and it was estimated that it would take the patient about 1hour to complete.

This questionnaire was sent only to the patients who had ticked the `yes`- box.

From the 934 patients that received such a `yes / no` - letter, there were 348 responses. 293 patients agreed to participate in the study. 18 patients did not wish to take part. 37 patients had passed away over the study period of 27 years and their relatives kindly returned the letter with a covering, explanatory note.

No reply was received from 586 patients. 351 letters were returned unopened by the post, marked with a stamp `unbekannt verzogen` (`moved away to an unknown location`). In 235 cases, no reply was received.

The 293 patients, who agreed to participate in the study, received an 18 - page questionnaire. 128 patients answered the questionnaire (43, 7 %). 10 of the 128 questionnaires had incomplete information and needed to be excluded. The remaining 118 questionnaires were included in the study.

No reply was received from 165 patients. 27 questionnaires were returned unopened by the post, marked with a stamp `unbekannt verzogen`. 138 patients did not answer or respond at all to the questionnaires sent to them, although they had originally agreed to participate in the study.

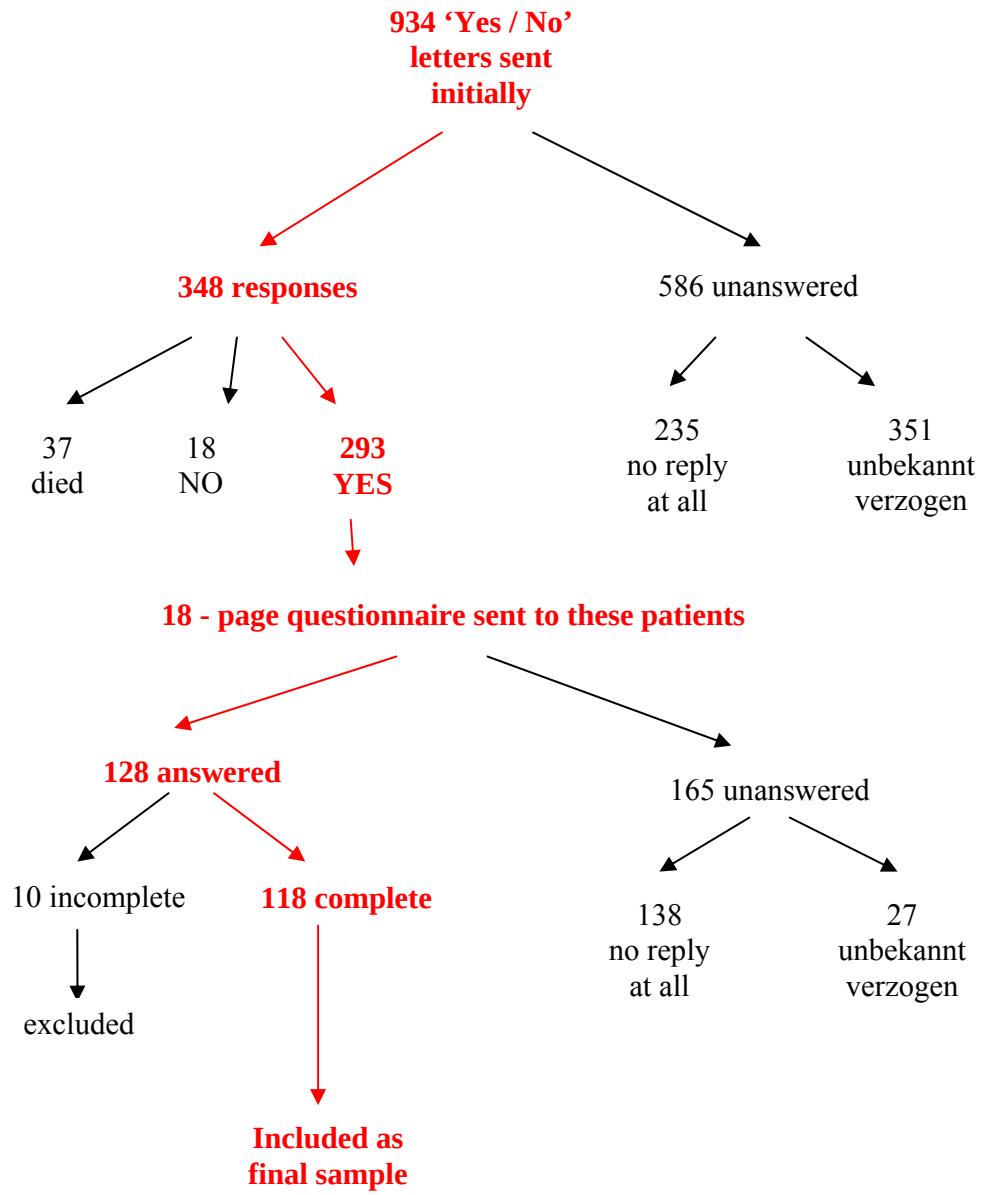


Figure 1: Flow chart of responses to patient letter and 18 - page questionnaire

## II.2 Inclusion Criteria

1. A Hand Injury Severity Score (HISS) of > 50. (Campbell, 1996)
2. Hand injuries distal to the carpus, i.e. the criteria to use the HISS.
3. Adequate hospital records to score the HISS.
4. Age ≥ 15, when completing questionnaire.
5. Completely answered questionnaires.[§]
6. A follow - up period of more than 12 months.
7. Patients with no pre - injury chronic upper limb condition.
8. Patients with no other chronic medical diseases.

## II.3 Hand Injury Severity Scoring System

For this thesis, the author found that no single classification system was on its own sufficient. Therefore, the `Hand Injury Severity Scoring System` (Campbell, 1996) has been supplemented with the `Definitions and Classifications in Replantation Surgery` (Biemer, 1980, p 165).

When choosing an assessment system for hand injuries, it is important to grade the patients in the study group according to the severity of their injuries. The HISS was designed with the aim of grading severity and predicting likely outcome. It is essential when assessing a hand injury to look at the entire organ and all its constituent components. The separate anatomical components of the hand distal to the carpus are divided into the broad constituent categories of: integument, skeletal, motor and neural (ISMN). Each ray is examined separately for injury in the four ISMN categories. After this examination, the total ISMN - score is multiplied by a weighting factor for that particular ray, since the same injury in different rays can be regarded as more severe in the functionally more important ray. (Campbell, 1996, p 295) In each ISMN category there are two types of points to be scored. There are those which must be multiplied by the weighting factor for that ray and those assigned absolute values which require no further modification. The absolute values apply in areas where assignation to a particular ray would not be possible, e.g. motor branches of median and ulnar nerves and skin loss on the dorsal and palmar aspects of the metacarpals. A reference sheet detailing the ISMN score is completed for each ray. These values are recorded on a scoring chart (Campbell, 1996, p 296) and a final hand injury severity

[§] Some sections did not necessarily need to be completed, e.g. optional DASH module. Other parts, e.g. work satisfaction, employment and income status, could not be completed by all patients, such as pensioners, pupils, housewives, and unemployed people. Patients were not excluded on these grounds.

score (HISS) is obtained. Modifications to allow for appropriate scoring of contaminated wounds have been added to the integument and skeletal categories. If a wound is crushed, dirty or contaminated or in any way different from a clean incised wound, the integument score should be doubled. Similarly, if a skeletal injury is open, this value should also be doubled. Both of these modifications should take place before multiplying by the weighting factor. Amputations should take all damaged structures into account. A HISS of ≤ 20 points can be regarded as an injury of `minor` severity. All injuries with a HISS between 21 and 50 are assigned to the `moderate` category. A HISS between 51 and 100 is `severe`, and ≥ 101 is `major`. (Campbell, 1996, p 297)

In 1979, `The Replantation Committee` of the International Society of Reconstructive Microsurgery presented their report of definitions and classifications in replant surgery. (Biemer, 1980) The author has used the replantation committee`s definitions and classifications for use in this study: (Biemer 1982, p 56)

**Total amputation:** There must be no remaining connection with the body.
There is separation of all structures.

**Subtotal amputation:** The main vascular connections must be interrupted and there must be no evidence of circulation in the distal part. Most of the functional structures must be separated and the soft tissue connection should be less than one - quarter of the circumference of the part. Without vascular anastomosis, necrosis would occur.

**Revascularisation:** Most of the functional structures are separated, but there is evidence of a residual circulation which can only be improved by a vessel anastomosis. The vascular anastomosis therefore serves only to improve the circulation of the peripheral part.

**Replantation:** In this study, which looked exclusively at injuries distal to the carpus, the term `Replantation` is equivalent to `Microreplantation`. (Biemer, 1980, p 164)
It is this technique that is required to restore vascularity to tissues that have been totally or subtotally amputated.

In addition, the amputation zones in the hand, described by Biemer (1980, p 166), were used in the study as well. These indicate the level of amputation:
Digit - Amputation - Zone I, II, and III; Midhand - Amputation - Zone IV; Hand - Amputation - Zone V.

The amputation zones were used in every patient to allow comparison of the different levels of injuries. The use of this classification facilitated accurate documentation of the HISS.

## II.4 18 - Page Questionnaire

The 18 - page questionnaire comprises a general part (page 1 - 6) and five specific questionnaires (page 7 - 18).

### II.4.1 General Part

Information was gathered on the patients` demographics, i.e. age, gender, marital status and education. Details were obtained about the hand injury itself, including handedness, type and mechanisms of injury, where the injury happened and which tissues of the hand were involved. This was completed by the patient with the aid of two hand diagrams. A brief description about how the traumatic incident occurred was requested. Number of operations and hospital admissions were recorded as well as date of injury and whether treatment has been completed or not. If treatment was not complete, patients were asked to state what kind of further therapy was still outstanding. The patients were asked about their postoperative symptoms, finger and hand function. Patients also had to state their satisfaction with the operation result (grade 0 - 10) and if they would undergo the operative procedure again. Length of hospital stay, time off work, and rehabilitation details were recorded. Further information was obtained about the patient`s employment status before and after the injury and the injury`s impact on the patient`s income level. Current job satisfaction was assessed on a scale from 0 to 10. The injury`s influence on the patients` spare time activities was evaluated.

### II.4.2 Specific Questionnaires

To be able to assess the quality of life of these hand injury patients accurately, a method of `triangulation` (Greenhalgh, 1997, p 741) was used. For this purpose, the following questionnaires were included in this quality of life outcome study:

- **DASH (Disability of the Arm, Shoulder, and Hand) - Questionnaire**
- **BDDE - SR (Body Dysmorphic Disorder Examination - Self Report), Munich Version - Questionnaire**
- **HADS (Hospital Anxiety and Depression Score) - Questionnaire**
- **FLZ (Fragen zur Lebenszufriedenheit) - Questionnaire**
- **FBeK (Fragebogen zur Beurteilung des eigenen Körpers) - Questionnaire**

### *II.4.2.1 Disability of the Arm, Shoulder, and Hand (DASH)*

The DASH questionnaire is a standardised outcome measure that captures upper extremity disability from the perspective of the patient and is used to study clinical outcome in musculoskeletal disorders. It evaluates the subjective perception of the patients with regards to their health. The DASH is a regional outcome measure, which conceptualizes the upper extremity as a single functional unit and allows comparisons across different upper extremity conditions. The DASH was developed by the Upper Extremity Collaborative Group (UECG) (1993). Its purpose is to measure the impact on function of a wide variety of musculoskeletal conditions and injuries affecting the upper limb and to quantify disability (predominantly physical function) and symptoms in people with upper limb disorders. (Solway, 2002, p 2) Symptoms that are addressed in the DASH - questionnaire include pain, weakness, tingling / numbness and stiffness. Functional status can be divided into three dimensions: physical, social, and psychological functioning. The instrument focuses primarily on measuring attributes linked to the physical functioning dimension. (Hudak, 1996, p 602) Valid and reliable instruments measuring the social and psychological dimensions already existed. Consequently, with the exception of three items, the UECG agreed that most of the components comprising the social and psychological functioning dimensions, such as depression, were best measured using other tools. In this study, the DASH has been used in combination with other instruments (HADS, BDDE - SR, FLZ, FBeK).
The components of social functioning that are included in the DASH are family care, occupation, and socializing with friends and relatives. Self - image is the only component within the psychological functioning dimension that is included, because other health measures do not ask about self - image, and the UECG believed self - image to be an important component of psychological functioning that is affected by an upper limb disorder.
There are different ways to measure the ability to function physically: Disability and functional limitations. However, these two terms differ. A person with functional limitations does not necessarily have a disability, as the individual is maybe still able to master the task or situation differently, because of adaptation or assisting devices. Most DASH items adopt the broader disability perspective. Disability is defined as difficulty doing activities in any domain of life due to health or physical problem. (Jette, 1994, p 11; Verbrugge, 1994, p 4) The DASH assesses symptoms and physical function at the level of disability, with a focus on physical function of any joint or condition of the upper limb. The two purposes of the DASH are:

1. To describe different groups of people (discriminative measure), i.e. people that can or cannot work. Therefore, it compares the impact of upper limb disorders among individuals.
2. To evaluate and assess change over time (evaluative measure), related to the natural history of the disorder or the effect of treatment interventions.

It is a 30 item self - report questionnaire, which takes about 15 minutes to complete. There are 21 physical function items (No 1 - 21), six symptoms items (No 24 - 29), two social function items (No 22, 23) and one item, belonging to the psychological dimension (No 30). In addition, the questionnaire has two optional four item modules designed to measure the impact of an upper limb problem when working, or when playing sport or performing arts. The goal of the optional modules is to identify the specific difficulties that professional athletes / performing artists or other groups of workers might experience, but which may not affect their activities of daily living and consequently may go `undetected` in the 30 item portion of the DASH. The optional modules are scored separately from the 30 item DASH disability score, because the items do not apply to all respondents. In this study, the optional module about sport and performing arts was used, because it was felt that these areas were under - represented in the other questionnaires. Patients are asked to circle the appropriate response to each question based on their condition in the last week. If they did not have the opportunity to perform an activity in the past week, they are asked to make their best estimate on which response would be most accurate. The DASH measures, whether people have the capacity to do a task, not whether they have performed the task. The intent of the DASH is to determine how well a person can do an activity, regardless of how it is done and regardless of which arm, shoulder or hand the person uses. Therefore, if respondents usually use an assistive device, they are asked to rate their ability to do the activity using the device.

The response options for each item are presented as a 5 - point Likert - Scale. At least 27 of the 30 items must be completed for a score to be calculated. The assigned values for all completed responses are simply summed and averaged, producing a score out of five. This value is then transformed to a score out of 100 by subtracting one and multiplying by 25. A higher score indicates greater disability.

$$\textbf{DASH-disability / symptom score} = \left[\left(\frac{\text{sum of n responses}}{n}\right) - 1\right] \times 25$$

(n is equal to the number of completed responses)

If more than 10 % of the items are left blank by the respondent, one cannot calculate a DASH disability score. By this same rule, no missing values can be tolerated in the work or high - performance sports / performing arts module, because the module consists of only four items. Two or more responses for a given item, whether or not they are adjacent to each other, need to be regarded as if the data were missing.
The DASH has been shown to be a reliable, valid and responsive tool for evaluating both proximal and distal disorders, confirming its usefulness across the whole extremity. (Solway 2002, p 63; Beaton, 2001, p 128) The questionnaire has been translated and validated for German - speaking countries. (Germann, 2003, p 13; Offenbächer, 2002, p 401) No normative data for the German population are yet available, only comparative data from a non - clinical population. (Jester, 2005, p 1076-1079)
The reason for inclusion of the DASH in this quality of life outcome study was that it is a well accepted and widely used measure of outcome after upper limb injury.

#### *II.4.2.2 Body Dysmorphic Disorder Examination - Self Report (BDDE - SR), (Munich Version)*

The Body Dysmorphic Disorder Examination Self - Report, Munich Version, developed in 2005 by Reichart in German, is based on a questionnaire, which was originally described by Rosen and Reiter (1993). The reasons to develop the Munich version of the BDDE - SR were as follows: The original English questionnaire by Rosen and Reiter was comprised of 3 parts and was thought to be too long. (Cunningham, 1996, p 370) Furthermore, an expert was needed for analysis of the instrument and no cut - off scores had been provided for this tool so far. There was no German translated, validated version existing. The aim was to develop a simple screening tool for the non-psychiatric setting, which is quick to complete, precise and reliable, and does not need the help of an expert. The use of cut - off scores should facilitate objective analysis. The BDDE - SR, Munich Version, does not claim to be able to make the diagnosis of body dysmorphic disorder, but it can identify patients who show body dysmorphic behaviour and symptoms and therefore are suspicious of a disturbance in the sense of a body dysmorphic disorder.
Diagnosis of a body dysmorphic disorder, which belongs to the hypochondriac disturbances, can only be made, if following criteria are fulfilled, according to the DSM - IV (APA 1994, p 535)

- The patient occupies himself excessively with the imaginary deficit or the disfigurement of the external appearance. If a minor physical anomaly is present, then the worries of the person are strongly exaggerated.
- The excessive occupation causes a clinical relevant suffering or impairment in social, professional or other important functional areas.
- The excessive pre - occupation cannot be explained due to another psychological disturbance.

Per definition, one can only diagnose a body dysmorphic disorder in a patient, who has no deficit or only has a mild deviation from the normal appearance.

The BDDE - SR was originally designed as a screening instrument for the pre - operative, non - psychiatric setting for the use of e.g. Plastic Surgeons, ENT - Surgeons, Dermatologist and Urologist, as it has previously been recognized that patients, who show symptoms of body dysmorphic disorder (BDD), seek attention especially with these specialists (Driesch, 2004, p 920).

This Self - Report measure is a practical self - rating questionnaire, takes about 5 minutes to complete, and is comprised of 18 items. Four items deal with pre - occupation of the `deficiency`, five items with the patient`s `suffering`, and seven questions with the `social interference`, within the last four weeks. Two items cannot be assigned clearly to a specific group.

Each item has a 5 - point Likert - Scale with 1 indicating the absence of the symptom. Answers 2 to 5 represent the frequency and intensity of the specific symptom.

This homogenous, one dimensional questionnaire does not include any items that need to be reversed. The sum score is calculated simply by adding the single item ratings. Therefore, the score can range from 18 (minimal manifestation of symptoms) to 90 (maximal manifestation of symptoms). The higher the score, the more pronounced are the symptoms. All 18 questions need to be answered for the analysis of the score. It is possible to raise the suspicion of a BDD with the help of a cut - off score. The cut - off score for subclinical body dysmorphic behaviour lies at a score of 63 points and above. The cut - off value for clinical manifest body dysmorphic behaviour lies by a score of 69 points and above. Below 63 points the patient is considered normal. Patients who reach scores above the cut - off value are recommended to be referred for further psychological assessment.

This questionnaire has been validated recently. (Reichart, 2006, unpublished). The instrument has shown good to very good psychometrical results regarding the quality of characteristics. There are comparative data available from a non - clinical control group sample.

Pre - occupation with the deficiency, suffering, and social interference are not relevant only for patients without a deficit in terms of a body dysmorphic disorder, but also for the exaggerated dysmorphic concern of patients with respect to their assessment of a real existing dysmorphic body part, their hand. This questionnaire has here the intention of evaluating body dysmorphic pre - occupation and symptoms.
It was felt by the author that inclusion of this questionnaire would improve the accuracy of this quality of life study by the triangulation method.

#### *II.4.2.3 HADS (Hospital Anxiety and Depression Score)*

The Hospital Anxiety and Depression Scale is a brief self - assessment mood questionnaire, which was developed by Zigmond and Snaith in 1983 in English to assess the levels of anxiety and depression among patients in non - psychiatric hospital departments (Zigmond, 1983, p 362) and to provide clinicians and scientists with a reliable, valid and practical screening tool for identifying and quantifying the two most common forms of psychological disturbances in medical and surgical patients. The anxiety and depressive subscales are valid measures of severity of the emotional disorder. Emotional disorder is a frequent concomitant of somatic illness and may even masquerade as a somatic disorder. (Snaith, 2003, p 1)
The HADS assesses the symptom severity and `caseness` of anxiety disorders and depression in somatic, psychiatric and primary care patients as well as in the general population. Depression can have a number of meanings: Demoralisation from prolonged suffering, reaction to loss (grief), a tendency to undervalue oneself (loss of self - esteem), a pessimistic outlook, etc. It was decided, to concentrate in the HADS questionnaire largely, but not entirely, on the loss of pleasure response (`anhedonia`). The reasoning for this was that anhedonic states belong to that form of depression which responds well to antidepressant drug treatment and therefore provides the most useful information for the clinician. Five out of seven depression items reflect aspects of reduction in pleasure response. (Zigmond, 1983, p 365)
Anxiety is a state of apprehension, uncertainty, and fear resulting from the anticipation of a realistic or fantasized threatening event or situation, often impairing physical and psychological functioning. (Concise Medical Dictionary, 1980, p 37)
The anxiety scale has been made out of items which represent typical manifestations of anxiety neurosis. (Herrmann, 1994, p 144)
HADS can indicate that a particular patient is probably a psychiatric `case` of anxiety or depression. However, it does not allow one to make definite diagnoses and gives a dimensional rather than categorical representation of mood.

Severely psychopathological symptoms are not covered. This is thought to improve acceptability and make the scale more sensitive to mild forms of psychiatric disorders, thus avoiding the `floor effect`, which is frequently observed when psychiatric questionnaires are used with medical patients. The HADS is sensitive to mild disturbances without relying on somatic symptoms. (Hinz, 2001, p 193)
It discriminates well between samples with high, medium, and low prevalence of anxiety or depressive disorder. The questionnaire does not include physical indicators of psychological distress such as headache or weight loss, which could give false positive results if they were in fact due to an underlying medical illness. (Zigmond, 1983, p 365; Bjelland, 2002, p 69) Finally, the scale score is not over - responsive to transient fluctuations in state which may occur in situations such as coming to a clinic. On the other hand, it responds well to mood changes which may occur during the course of a disease. Thus, the scale is a prolonged state rather than trait measure.
The HADS is a reliable and valid instrument for screening for clinically significant anxiety and depression in medical and surgical patients (Zigmond, 1982, p 364) and gives clinically meaningful results as a psychological assessment tool, in clinical group comparisons and in correlation studies with several aspects of disease and quality of life. Finally, HADS scores predict psychosocial and possibly also physical outcome.
The questionnaire instructs the patients to document, how they have felt in `the past week`, to reflect the present state of mood. The HADS scale consists of 14 items (7 for each subscale anxiety and depression) which makes it easy to administer and is therefore a useful screening instrument to evaluate dimensional representation of mood. The scale can be completed in under 10 minutes (Snaith, 2003, p 3; Herrmann, 1997, page 18). All items are scored on a 4 - point scale from 0 to 3. Therefore, the maximum sum score for each subscale is 21. If one item is unanswered, then this can be compensated by calculation of an individual mean value for that person. If two or more items are missed, the scale is no longer valid.
There is no single, generally accepted cut - off score for the HADS. In this quality of life study, the following cut - off scores were used: 0 - 7 (normal spectrum); 8 - 10 (borderline); 11 - 14 (`caseness`); ≥ 15 (severe). (Zigmond, 1982, p 365; Snaith, 1994, p 3) The two subscales, anxiety and depression, are independent measures. Each mood state can be divided into four ranges: normal, mild, moderate and severe.
HADS can differentiate groups with different prevalence or intensities of anxiety and depression. It allows longitudinal assessments with repeated testing at intervals of about 1 week or more and is sensitive to changes in patients` emotional state. It is well

documented to predict mood over intervals of 1 year and longer. It also predicts compliance, quality of life (HADS depression), and physical symptoms (HADS anxiety).
The HADS is a reliable and valid instrument for assessing anxiety and depression. (Herrmann, 1997, p 32; Bjeland, 2002, p 75; Bowling, 2001, p 85) A German version was developed and validated by Herrmann in 1994. (Herrmann, 1994, p 143) Standardised values were calculated on the basis of a representative sample of the German population. (Hinz, 2001, p 196)
Reasons for inclusion of this questionnaire in this study are that quality of life will be adversely affected by anxiety and depression states. The depression scale is particularly useful for assessing quality of life, as it looks at reduction in pleasure response.

#### *II.4.2.4 FLZ (Fragen zur Lebenszufriedenheit)*

The FLZ - questionnaire is a questionnaire for the assessment of subjective quality of life. The FLZ is a standardized, economical, modular questionnaire.
The `Questions on Life Satisfaction - Modules` (`Fragen zur Lebenszufriedenheit - Modules`) have been developed in different stages since 1986. (Henrich, 2001)
The questionnaire, developed in German, consists of three parts or modules:

1. The module of `General Life Satisfaction` includes eight items that are assessed each by the respondent with regards to subjective satisfaction and additionally subjective importance.
2. The module of `Satisfaction with Health` includes eight relevant aspects of health which are assessed according to subjective satisfaction and subjective importance.
3. The third module of `External Appearance` includes 22 different body parts which are assessed according to subjective satisfaction and subjective importance.

The module `General Health` and `External Appearance` includes additionally a question about global life satisfaction.
The two modules about `General Life Satisfaction` and `Health` are conceived as measures of general quality of life and health related quality of life, respectively.
The FLZ modules can be completed in a few minutes (2 - 5 min per module). The instructions for the module `General Life Satisfaction` and `Health` state that the ratings refer to the past four weeks. This is to differentiate life satisfaction from the psychological construct of `mood`, which describes a momentary state and which can

vary over the course of the day. The respondent is first asked to rate the `subjective importance` of a given area of life: `How important is item x for your overall satisfaction?` In this way the principle of individual weighting is realized. Then the respondent is asked about the degree of satisfaction in that area. All responses are given on a 5 - point scale. The scale of importance includes the category `extremely important`, resulting in a distribution of responses that is less skewed to the left. The asymmetrical response scale for satisfaction has two negative and three positive responses to choose from. This design increases the degree of differentiation possible in the positive range.

The `General`- module covers eight areas of life that are usually relevant to some degree for everyone in the Western world: Friends / acquaintances, leisure time / hobbies, health, income / financial security, occupation / work, housing / living conditions, family life / children, and partner relationship / sexuality. It can therefore be used with very different groups of subjects, making comparisons possible.

The `Health` - module includes the eight dimensions: Physical condition / fitness, ability to relax / stay on even keel, energy / zest for life, mobility (e.g. walking, driving), vision and hearing, freedom from anxiety, freedom from aches and pains and independence from help / care.

The `External Appearance` - module includes 22 different part of the body: Scalp hairs, ears, eyes, nose, mouth, teeth, facial hairs, chin / neck, shoulders, breasts, abdomen, waist, hips, penis / vagina, buttocks, thighs, feet, hands, skin, body hairs, height, weight. The importance and satisfaction are assessed as follows:

Two values can be used for each item:

1. The weighted satisfaction after the formula:
   Weighted Satisfaction = (Importance – 1) x (2 x Satisfaction – 5)
   The weighted satisfaction describes the share of the appropriate aspect of life (or aspect of health) in the global life satisfaction.
2. The importance as a scale of subjective weighting of an item for the quality of life of a respondent. This value reflects the influence of copying processes.

The sum score of the weighted satisfaction describes the global satisfaction for each module with the appropriate content. Six of the eight items need to be present to calculate a sum score.

The modules have been tested and evaluated for their psychometrical characteristics and have been standardised for the German population. (Henrich, 2000, p 156) Additionally, there are comparative data available of over 11 000 patients from

various backgrounds of diagnoses as well as over 6000 healthy persons. (Henrich 2001, p 1)

The FLZ questionnaire was chosen for inclusion in this study, because as a subjective measurement tool of quality of life, consisting of several dimensions, it includes weighting for the relative importance of each dimension for the individual concerned. Clearly, the rating on a dimension that is of little importance to an individual should not contribute the same amount to the overall quality of life score as the rating on a dimension that is especially important. In the view of the author, it is the most comprehensive quality of life questionnaire available.

#### *II.4.2.5 FBeK (Fragebogen zur Beurteilung des eigenen Körpers)*

The FBeK was first published in 1983. (Strauss, 1983) It was developed within the framework of a psycho - endocrinological project in Gynaecology and for assessment of subjective body - perception. (Strauss, 1996, p 4) It is one of the most widespread questionnaires used in Germany for assessing peoples` subjective views of their own bodies. The FBeK is a multi - dimensional body - questionnaire. (Brähler, 2000, P 156) The authors of the FBeK have suggested either a three scale model (with 52 items) or a four scale model (with 46 items). The items are answered either with `agree` (= 1) or `disagree` (= 0).

The 3 - factor model (Strauss, 1983) included the following scales:

1. Insecurity / Misperception (19 items);
2. Attractivity / Self - Confidence (13 items);
3. Accentuation of the body / Sensibility (20 items).

In 1996, a four scale model was introduced, which was felt to be more accurate:

1. Attractivity and Self - Confidence (15 items, which describe particularly the satisfaction with the patients`own body);
2. Accentuation of the Physical Appearance (12 items, which emphasize the appearance and explore the patients` perception of their own appearance);
3. Insecurity towards physical events and a feeling of deficient bodily self - control (13 items);
4. Physical - sexual misperception as well as aspects of shame in connection with physical experiences (6 items).

An abbreviated version of the FBeK - questionnaire was used and only the first and second scales of the four scale model were included. The reason for using a shortened version was that scale 3 and 4 correlate highly with scale 1 and it was felt by the author that little would be gained by their inclusion. It has also been shown that

particularly the first two scales are good in distinguishing patients from healthy respondents. (Strauß, 1996, p 21) The FBeK - questionnaire includes `negative` items as well, which need to be reversed. The scale scores are summed to produce scores for scale one between 0 and 15 points and for scale two between 0 and 12 points.
The questionnaire has been validated and psychometrically tested. (Strauss, 1996, p 16) Normative data for the FBeK were collected with help of a large scale representative survey of the German population. (Brähler, 2000, p 163)
The FBeK was chosen for inclusion in this quality of life outcome study, in order to obtain further information about how this patient group regarded their own bodies.

## II.5 Statistical Analysis

This study contains different types of variables: dichotomous -, nominal - and ordinal - categorical variables, Likert - Scales, and a number of quantitative measurement scales and continuous variables. A variety of statistical hypothesis tests have been used in order to analyse the variables appropriately.
The Likert - Scales have been analysed as if they are quantitative variables, but non - parametric tests were used, so that no assumptions need to be made about their distribution. Frequency of pain was originally recorded as an open text question. In order for it to be analysed, it was coded into four categories of increasing frequency of pain and so has been analysed as a Likert - Scale variable. The normality of the distribution of the various other quantitative variables was assessed using graphical representation and the following guideline: For a variable, which can only be positive if the standard deviation is less than half of the mean, then it is deemed to be normal.

In tabular form, categorical and Likert - Scale variables have been summarized using counts and percentages. Normally distributed variables were summarized using mean and standard deviation. Non - normally distributed variables were summarized using the median, minimum and maximum. Categorical and Likert - Scale variables have been graphically presented using bar or clustered bar charts or pie diagrams. The distribution of quantitative variables has been graphically presented using histograms and box plots and the relationship between two quantitative variables has been shown with scatter plots.

When the relationship between two dichotomous or other categorical variables was being tested, chi - squared analysis was used. If there are more than 25% of cells in the cross tabulation with an expected count less than 5, a Fishers Exact Test is more

appropriate and was used. Otherwise a Pearson Chi - Square Test was used. If the chi - squared analysis showed there to be a significant difference between groups, post - hoc pair wise comparisons using Fishers Exact Tests or Pearson Chi - Square Tests as appropriate with Bonferroni adjustment were carried out in order to assess which pairs of groups were significantly different from each other.

When two groups are being compared in terms of a quantitative normally distributed variable, an unpaired t - test is appropriate. A Levene's test of equality of variance was first performed to assess, whether the variances of the two groups could be assumed to be equal and then the appropriate unpaired t - test was carried out.
If the quantitative variable was not normally distributed, a Normal Approximation to the Mann - Whitney Test was used. It was felt appropriate to use the Normal Approximation due to the relatively large sample size.

When more than two groups were being compared in terms of a quantitative normally distributed variable, one - way analysis of variance (ANOVA) was used. If the ANOVA showed there to be a significant difference between groups, post - hoc pair wise comparisons, using unpaired t - tests, with Bonferroni adjustment were carried out in order to assess which pairs of groups were significantly different from each other. If the quantitative variable was not normally distributed, then Kruskal - Wallis - Chi - Square Tests were carried out to assess, whether the variable was distributed differently between the groups. If the Kruskal - Wallis - Chi - Square Tests showed there to be a significant difference between groups, post - hoc pair wise comparisons using Normal Approximation to the Mann - Whitney Tests with Bonferroni adjustment were carried out in order to assess which pairs of groups were significantly different from each other
When the relationship between two quantitative variables was being analysed, Spearmans Rank Correlation Coefficients were used as many of the quantitative variables were not normally distributed.
Multiple regression models were fitted to further analyse the relationships between the study variables. These included FLZ - General Life Satisfaction and FLZ - Satisfaction with Health as the dependent variables. The regression models aim to further explore the relationship between these dependent variables and other variables which had previously shown to be related to them. FLZ - General Life Satisfaction and FLZ - Satisfaction with Health are normally distributed. Therefore, parametric regression techniques were appropriate. Quantitative variables to be made available

for the regression model were dichotomized if they were highly skewed. A few other variables were omitted from this analysis due to missing data. Independent variables were selected for entry into the model using the stepwise selection method.

Many hypothesis tests are being carried out in this study, thus increasing the likelihood of a Type 1 error. Therefore, it was felt appropriate to apply a Bonferroni correction in a systematic manner. When post hoc pair - wise comparisons were used, Bonferroni adjustments have been made.

In analyzing the measures in this study, three main sets of analyses were carried out: The first analysis looked at whether the measures differed between various socio - demographic groups, treatment types and length of follow - up. In this analysis there are nine variables in all, hence the adjusted level for variables to be deemed to be significant at, is reduced to 0.05/9 = 0.006 (to 3 decimal places). In the second analysis, the measures were compared between those people who had reported different sensory disturbances and those who hadn't. Eleven sensory disturbances were being tested. Therefore, the adjusted significance level is 0.05/11=0.005 (to 3 decimal places). In the third analysis, correlations between each of the 19 quantitative variables were calculated. Each of the 19 variables was correlated with the 18 others. Therefore, the significance level was adjusted to 0.05/18 = 0.003 (to 3 decimal places).

All statistical analysis was carried out using SPSS (Statistical Package for Social Sciences) Version 13.0 (1 Sep 2004) for Windows.

# III Results

## III.1 Demographic Data

118 patients met all the inclusion criteria for this quality of life outcome study. 103 patients (87.3 %) were male, 15 patients (12.7 %) were female. At the time of filling in the questionnaire, 66 % of patients were married, 28 % single, 3 % divorced and 3 % were widowed. The patient group had a varied level of education: 0.9 % had no school qualification, 64.4 % had completed `Hauptschule`, 19.5 % had a `Realschul`-, 5.9 % had a `Fachschul`- qualification, and 9.3 % of patients had `Abitur`. Analysing the completed professional qualification of the 118 patients, it was found that 8.5 % had no job qualification, 57.6 % had a completed apprenticeship (`Lehre`), and 2.5 % had visited a `Handelsschule`. 21.2 % had a `Fachhochschul` - degree and 7.6 % had a University qualification. 2.5 % of the 118 patients were still in professional training. The employment pattern can be seen in pie - diagram, Figure 2.

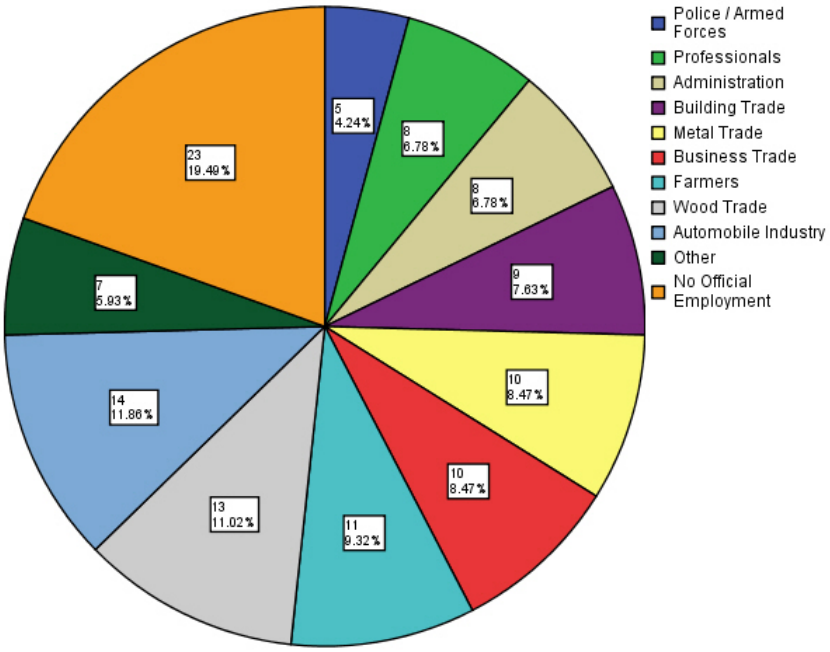


Figure 2: Occupation at the time of hand injury

## III.2 Hand Injury

| *Variables* | *Mean (Std)* | *Median* | *Minimum* | *Maximum* |
|---|---|---|---|---|
| Age at hand injury (years) | 37.4 (16.5) | 37.4 | 1.8 | 68.3 |
| Age at completion of questionnaire (years) | 47.8 (16.1) | 48.3 | 15.8 | 82.2 |

Table 1: Patients - Age (years)

107 patients (90.7 %) were right handed, 11 patients (9.3 %) left handed. 64 (54.2 %) injured their dominant hand. 57 patients (48.3 %) sustained an injury to their right hand. 59 patients (50%) had their left hand injured. 2 patients (1.7 %) injured both hands. 97 patients (82.2 %) had injured their digits only and in 21 patients (17.8 %) the injury was involving the hand as well. The number of digits injured ranged from 0 to 6 (mean = 2.2; median = 2).

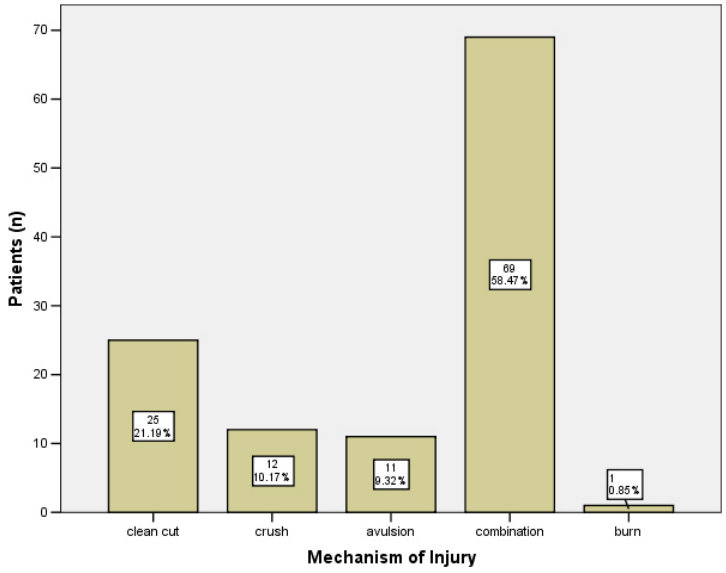


Figure 3: Distribution of different mechanisms of injury

55 out of the 69 combination injuries were caused by a circular saw (79.7 %).
The rest, 14 (20.3 %), were caused by another machine.
53.4 % of injuries were caused during spare time activities. 44.1 % of patients sustained the injury at work. 2.5 % were road traffic accidents.

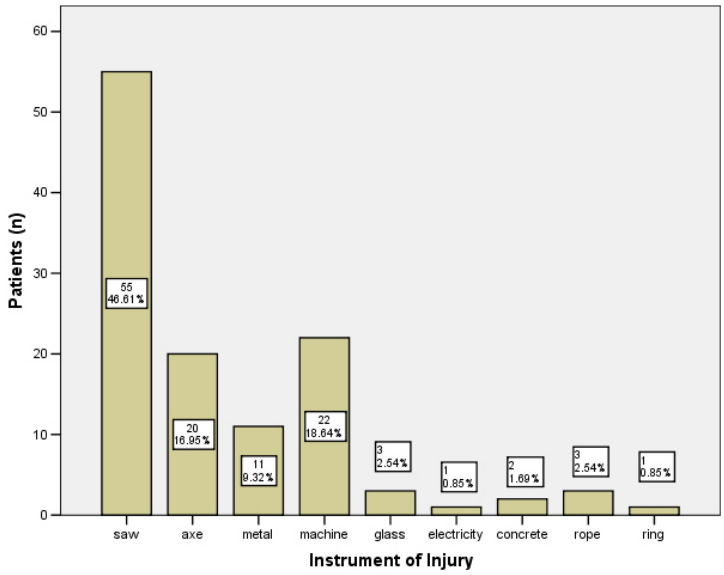


Figure 4: Distribution of different instruments of injury

The patients can be divided into six hand injury severity groups with a mean HISS of 209.2 (Std = 125.8; median = 183; range = 51 - 704).

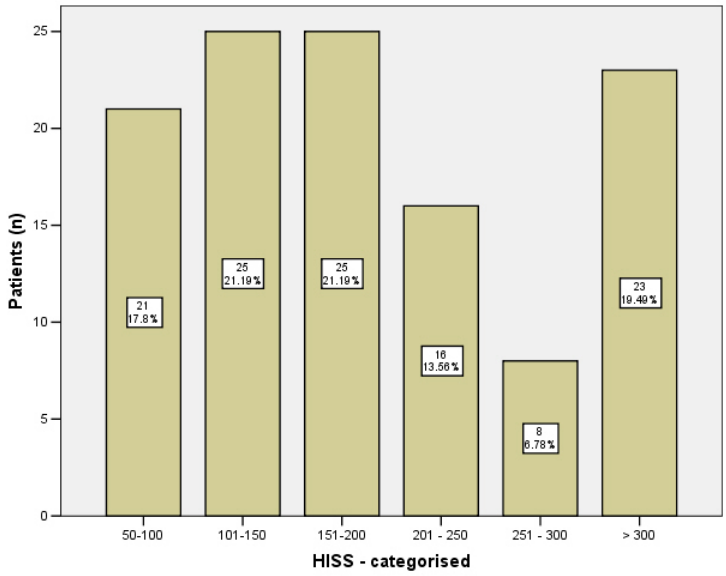


Figure 5: Hand Injury Severity Score - Categories

The two box plot graphs (Figure 6 and 7) relate the patients` HISS to the instruments and mechanisms of injury. As expected, the most severe hand injuries were caused by electrical machinery. The HISS in the machine group ranged from 96 to 704 points with 50 % of these patients falling between 165 and 416 points. The next most severe injuries were caused by circular saws. 4 outliers, all with HISS > 400 points, were exceptions to this group, whose range was between 50 and 604 points, with the box itself being between 144 and 274 points.

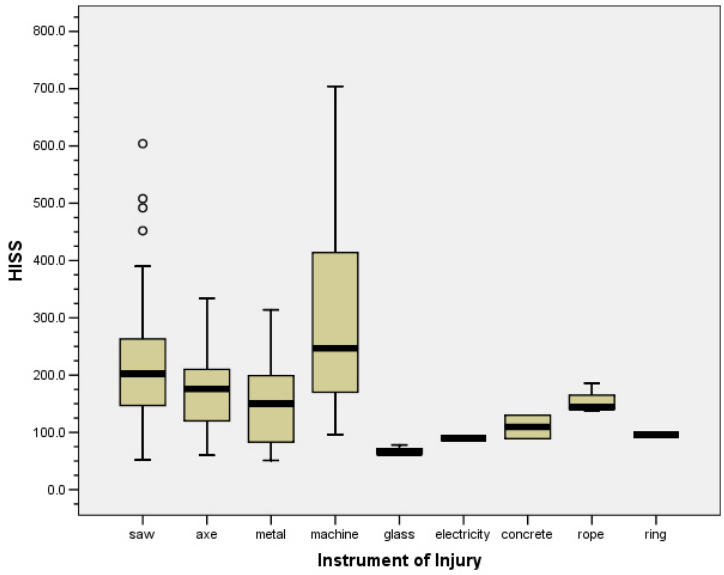


Figure 6: Box Plot 1: Instruments of injury related to Hand Injury Severity Scores

The median values for mechanisms of injury were similar: HISS of 150, 141, 174, and 218 for clean cut, crush, avulsion, and combination injuries, respectively.

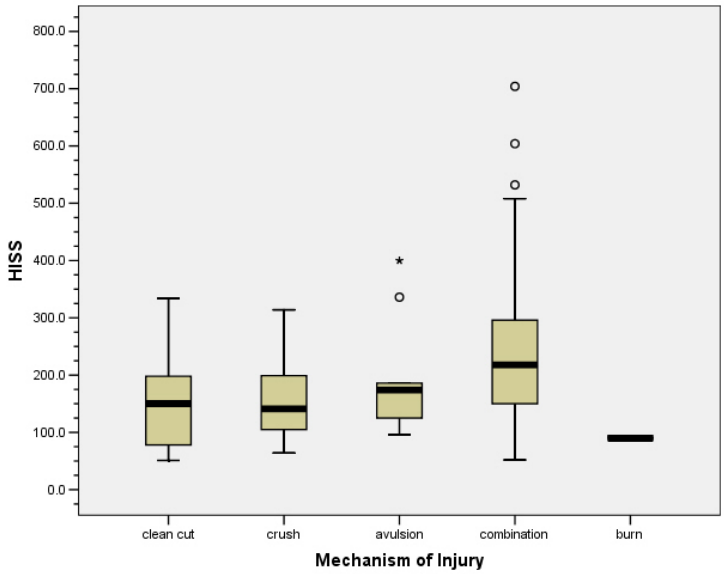


Figure 7: Box Plot 2: Mechanisms of injury related to Hand Injury Severity Scores

(Box plots show the median (thick black horizontal line), inter-quartile range (the box extends from the lower to the upper quartile range, hence indicates where the middle 50% of data lie), outliers, and extreme cases of individual variables. The lines extending from the box indicate the minimum and maximum values except when these meet the criteria for being classed as outliers or extreme cases as defined below. **Outliers** (indicated by a **circle**): Cases with values between 1.5 and 3 box lengths from the upper or lower edge of the box. The box length is the inter-quartile range.
**Extreme values** (indicated by a *****): Cases with values more than 3 box lengths from the upper or lower edge of the box. The box length is the inter-quartile range.)

## III.3 Treatment

III.3.1 Patient Group - Subdivision

The 118 patients have been placed into one of four groups to describe their main type of operative treatment. The four treatment groups are divided as follows:

**Replant Group:**

Patients, who have had replant(s) performed and may have also had other operative procedures[♣] to their hands and digits. Terminalizations were excluded from this group. There were 45 patients (38.1%) in the Replant Group.

**Stump Group**:

Patients, who have had terminalization(s) performed and may have had also other operative procedures[♣] to their hands and digits. Replants were excluded from this group. 29 patients (24.6%) belonged in the Stump Group.

**Mixed (Replant and Stump) Group:**

Patients, who have had replant(s) and terminalization(s) performed and also may have had other operative procedures[♣] to their hands and digits. 24 patients (20.3%) had both replants as well as terminalizations performed.

**Other Group:**

Patients, who have not had replants or terminalizations performed, but instead had other operative procedures[♣] performed to their hands and digits. There were 20 patients (16.9%) in this group.

III.3.2 Treatment Methods

**Replantations**

A total of 124 replants were performed, of which 32 (25.8 %) digital replants failed. Therefore, there were 92 (74.2 %) successes. The results regarding the number of different digits or hands successfully replanted are as follows: 49 patients had 0 fingers replanted, 46 patients had 1 finger replanted, 13 had 2 fingers replanted, 5 had 3 fingers replanted, and 5 had a hand replanted. Of the 32 failed replanted digits, 28 were terminalized (9 on right side; 19 on left side) and four digits were reconstructed with a free toe - transfer (3 to right thumb; 1 to left ring finger).

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[♣] E.g.: Tendon repair, neural coaption, revascularisation, bony fixation, soft tissue reconstruction.

| *Digit/Hand* | *Right* | | | *Left* | | | *Total replanted* |
|---|---|---|---|---|---|---|---|
| | *Replants* | *Successful* | *Failed* | *Replants* | *Successful* | *Failed* | |
| Thumb | 14 | 10 | 4 | 18 | 14 | 4 | 32 |
| Index | 17 | 12 | 5 | 13 | 8 | 5 | 30 |
| Middle | 11 | 9 | 2 | 12 | 8 | 4 | 23 |
| Ring | 8 | 8 | 0 | 13 | 9 | 4 | 21 |
| Little | 6 | 5 | 1 | 7 | 4 | 3 | 13 |
| Hand | 1 | 1 | 0 | 4 | 4 | 0 | 5 |

Table 2: Replantations - successes and failures

## Terminalisations

The results regarding the number of different digits terminalized are as follows:
65 had no finger terminalized, 32 had 1 finger terminalized, 14 had 2 fingers, 4 had 3 fingers, and 3 had 4 fingers terminalized. Therefore, a total of 84 terminalizations were performed.

| *Digit/Hand* | *Right* | *Left* | *Total* |
|---|---|---|---|
| Thumb | 3 | 10 | 13 |
| Index | 17 | 10 | 27 |
| Middle | 11 | 7 | 18 |
| Ring | 5 | 5 | 10 |
| Little | 7 | 9 | 16 |
| Hand | 0 | 0 | 0 |

Table 3: Terminalizations

## Revascularisations

In 11 patients there were 15 revascularisations performed: 8 patients had 9 revascularisations on the right hand side with one patient having two revascularisation procedures: 2x thumb, 2x index finger, 1 middle finger, 4x ring finger. 3 patients had 6 revascularisations on left hand side with one patient having four revascularisation procedures: 1x index finger, 2x middle finger, 2x ring finger, 1x little finger.
The 15 revascularisations were spread across the four treatment groups as follows: Replant Group: 2, Stump Group: 2, Mixed Group: 1, and Other Group: 10 revascularisations. None of the revascularized digits required terminalization.

**Reconstruction of Soft Tissue**

71 (60.2 %) patients had no soft tissue reconstruction. 47 (39.8 %) patients had reconstructions performed (28 procedures on right side, 27 procedures on left side). The reconstructed areas of the hand and digits included: 10 x thumbs, 10 x index fingers, 11 x middle fingers, 6 x ring fingers, and 1 x little finger. 9 patients had reconstructive procedures on the hand itself.

The reconstructive procedures were as follows: Right hand: 7 free toe - transfers, 7 distant pedicled flaps, 2 regional flaps, 1 homodigital flap, 8 skin / composite grafts, 3 pedicled finger transfers from one digit to another. Left hand: 2 free toe - transfers, 2 other free flaps, 4 distant pedicled flaps, 1 heterodigital flap, 8 homodigital flaps, 9 skin / composite grafts, 1 pedicled finger transfer from one digit to another.

III.3.3 HISS across Treatment Groups

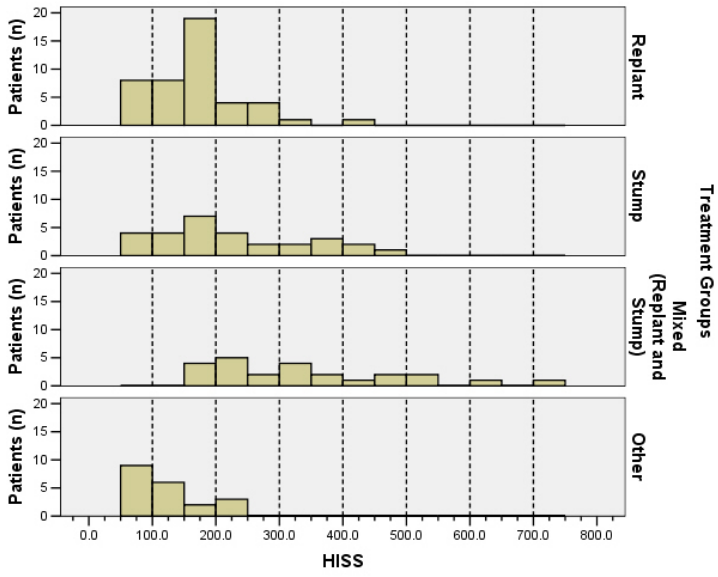


Figure 8: Hand Injury Severity Scores compared between treatment groups

The Mixed Group had the highest HISS, reflecting the more severe multi - digit injuries within this group. The minimum score was 150, more than double the minimum score in any of the other groups. The Other Group had the lowest level of injury severity.

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Replant | 45 | 169.1 | 79.47 | 52.0 | 421.0 |
| Stump | 29 | 226.3 | 115.65 | 64.0 | 492.0 |
| Mixed (Replant and Stump) | 24 | 337.8 | 148.59 | 150.0 | 704.0 |
| Other | 20 | 120.4 | 54.09 | 51.0 | 236.0 |
| Total | 118 | 209.2 | 125.80 | 51.0 | 704.0 |

Table 4: Hand Injury Severity Scores compared between treatment groups

The 118 patients had a mean hand injury severity score of 209.2, with a few patients sustaining extremely severe injuries. The Std (125.8) reflects an abnormal distribution of hand injury severity scores with most patients having had a HISS < 300. However, when the 118 patients were subdivided into the four treatment groups, one can see that within each treatment group, the severity scores were approximately normally distributed, as evidenced by the standard deviation, being around half or less than half of the mean values. One - way analysis of variance showed that the four groups differed significantly in HISS scores ($F = 19.87$; $p < 0.001$). Post - hoc pair wise comparisons indicated that the HISS scores were significantly greater in the Mixed Group than all other groups ($p \leq 0.001$). The Stump Group had significantly higher HISS scores than the Other Group ($p = 0.004$). The Replant Group did not differ significantly from either the Stump ($p = 0.131$) or the Other Group ($p = 0.490$).

### III.3.4 Hospital Data

The majority of patients (66 %) had either one or two operations. 15 required ≥ 5. The mean number of operations per patient was 2.6 (Std =2.3; median=2; range = 1-15).

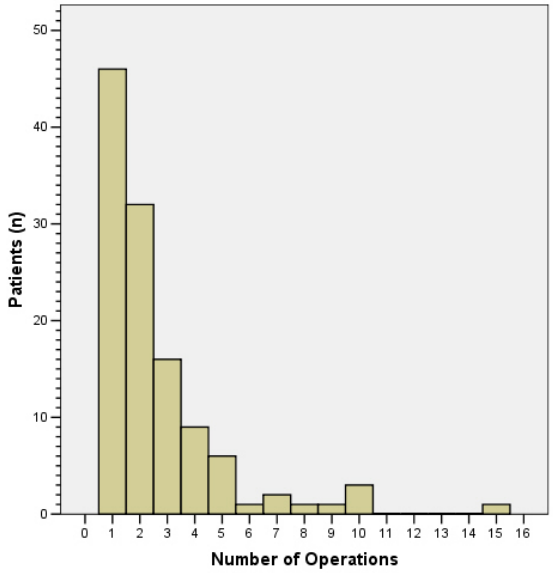


Figure 9: Number of operations

Figure 10 reveals the frequency of admissions to the rechts der Isar Hospital in Munich for this patient group (mean = 2; Std = 1.9; median = 1; range = 0 - 15).

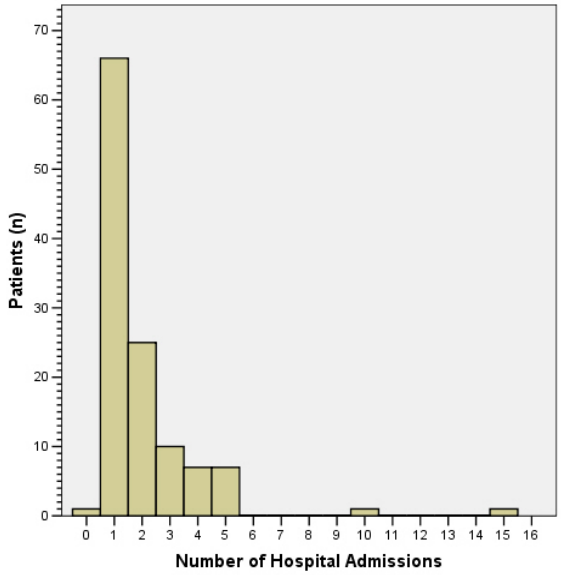


Figure 10: Number of hospital admissions

The length of stay in hospital was reported by each patient as cumulative time of all hospital admissions. 83 patients (70.3 %) were admitted to the hospital for up to 4 weeks, 25 patients (21.2 %) were admitted between 4 and 8 weeks, and 10 patients (8.5 %) for more than 8 weeks. Of the 10 patients, who were admitted for more than 8 weeks, 9 patients were admitted for 24 weeks or less and 1 patient was admitted for 54 weeks.

Subdivision into the four treatment groups revealed that nearly the same percentage of patients from the Other Group (80 %) and the Stump Group (79.3 %) spent less than 4 weeks in hospital, followed by the Replant Group (73.3 %) and the Mixed Group (45.8 %). In comparison, a higher percentage of the Mixed Group spent 4 - 8 weeks (33.3 %) and more than 8 weeks (20.8 %) in hospital.

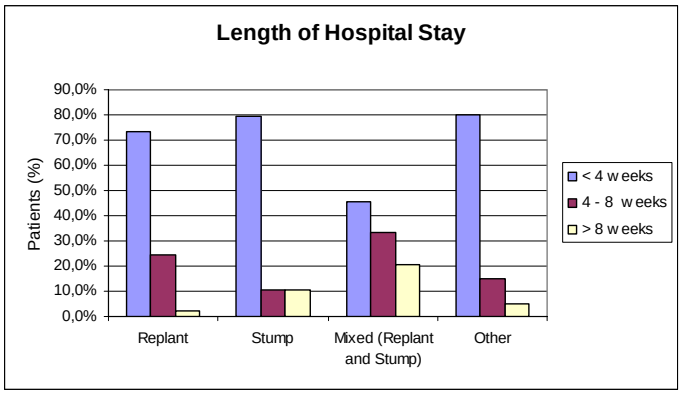


Figure 11: Length of hospital stay compared between treatment groups

| | | Treatment Groups | | | | |
|---|---|---|---|---|---|---|
| | | Replant | Stump | Mixed (Replant and Stump) | Other | Total |
| Length of Hospital Stay | < 4 weeks | 33 (73.3 %) | 23 (79.3 %) | 11 (45.8 %) | 16 (80 %) | 83 (70.3 %) |
| | 4 - 8 weeks | 11 (24.4 %) | 3 (10.3 %) | 8 (33.3 %) | 3 (15 %) | 25 (21.2 %) |
| | > 8 weeks | 1 (2.2 %) | 3 (10.3 %) | 5 (20.8 %) | 1 (5 %) | 10 (8.5 %) |
| | | 45 (100 %) | 29 (100 %) | 24 (100 %) | 20 (100 %) | 118 (100 %) |

Table 5: Length of hospital stay compared between treatment groups

A Fishers Exact Test indicated that the distribution of length of hospital stay differed between the treatment groups significantly (Fishers Exact Test = 12.63; p = 0.034). Post - hoc pair wise comparisons of the four groups revealed that the Mixed and Stump Groups were significantly different from each other (Fishers Exact Test = 6.45; p = 0.047). The Mixed differed also significantly from the Replant Group (Fishers Exact Test = 8.00; p = 0.014). No other pairs were significantly different from each other. A Bonferroni correction can be applied. As there were six pair wise comparisons being performed, this indicated that pair wise differences, significant at the 0.06/6 = 0.008 - level, remained significant after correction.

When comparing length of hospital stay to the severity of hand injuries, it was found by using one - way analysis of variance that the 118 patients differed significantly in terms of their mean HISS between those patients with different hospital length stays (F = 10.34; p < 0.001).

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| < 4 weeks | 83 | 191.964 | 111.9645 | 51.0 | 508.0 |
| 4 - 8 weeks | 25 | 202.400 | 112.8162 | 60.0 | 604.0 |
| > 8 weeks | 10 | 369.300 | 161.9630 | 170.0 | 704.0 |
| Total | 118 | 209.203 | 125.8013 | 51.0 | 704.0 |

Table 6: Hand Injury Severity Scores related to length of hospital stay

Post - hoc pair wise comparisons indicated that the HISS scores differed significantly between patients that stayed > 8 weeks and those that had shorter hospital stays (p < 0.001). However, the two short stay groups did not differ from each other. It can be seen that patients with shorter hospital stays had a mean HISS of around 200, but those remaining in hospital longer, had a mean HISS of 369, a lot higher. Another

point of interest is that the minimum HISS in the long stay group was 170, much higher than the other two groups. Patients with the most severe injuries stayed in hospital longer, although most people were discharged before 8 weeks (91.5 %).

III.3.5 Rehabilitation

55 patients (46.6 %) were admitted for rehabilitation. The mean length of admission was 6.6 weeks (Std = 4.1; median = 5 weeks; range = 2 - 24 weeks).

| | | Treatment Groups | | | | Total |
|---|---|---|---|---|---|---|
| | | Replant | Stump | Mixed (Replant and Stump) | Other | |
| Admission for Rehabilitation | Yes | 20 (44.4 %) | 10 (34.5 %) | 17 (70.8 %) | 8 (40 %) | 55 (46.6%) |
| | No | 25 (55.6 %) | 19 (65.5 %) | 7 (29.2) | 12 (60 %) | 63 (53.4%) |
| Total | | 45 (100 %) | 29 (100 %) | 24 (100 %) | 20(100 %) | 118(100%) |

Table 7: Admissions for rehabilitation compared between treatment groups

The Mixed Group were most likely to be admitted for rehabilitation (70.8 %), the Stump Group least likely (34.5 %). Pearson - Chi - Square analysis showed that there is a borderline statistically significant difference between the four treatment groups in terms of whether they were admitted for rehabilitation or not (Chi - Square = 7.81; $p = 0.050$). Post - hoc pair wise comparisons revealed that there was a statistically significant difference between the Mixed and the Replant Group (Chi - Square = 4.38; $p = 0.036$), between the Mixed and the Stump Group (Chi - Square = 6.94; $p = 0.008$), and between Mixed and the Other Group (Chi - Square = 4.23; $p = 0.040$). No other pairs were significantly different from each other. After Bonferroni correction for multiple pair wise comparisons, the Mixed and Stump Group remained significantly different from each other.

Mean - HISS for those admitted for rehabilitation was 258.3 (Std = 143.9). Mean - HISS for those not admitted for rehabilitation was 166.3 (Std = 88.5). These mean values were significantly different ($t = 4.24$; $p < 0.001$).

III.3.6 Completion of treatment

The mean length of time to completed treatment was 9.6 months (Std = 15.6; median = 5 months; range = 0 - 120 months). This Std of 15.6 is large compared to the mean indicating that length of completed treatment is not normally distributed, which is

expected with this type of variable. The flow chart (Figure 12) describes the time from injury to completion of treatment for the patient population.

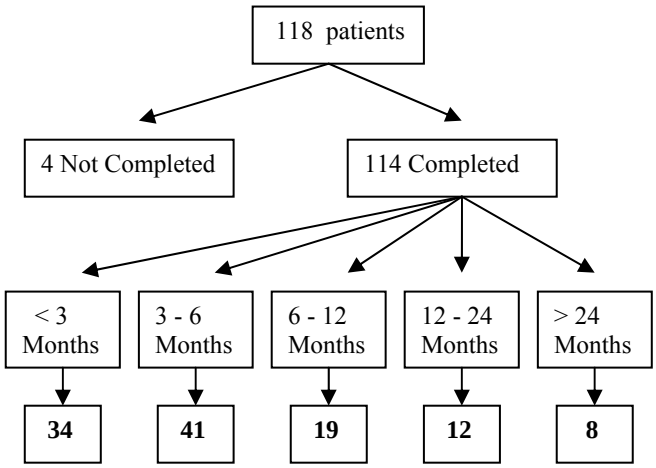


Figure 12: Flow chart of completed treatment

The mean length of time since injury was 10.2 years (Std = 7.8; median = 8.5; range = 1.08 - 29 years).

## III.4 Outcome

III.4.1 Hand Function

When assessing the outcome of the 118 study group, the patients were initially asked four questions. Answers to these questions were presented on a 5 - point Likert - Scale. The patients` responses are shown graphically below (Figure 13 - 16).

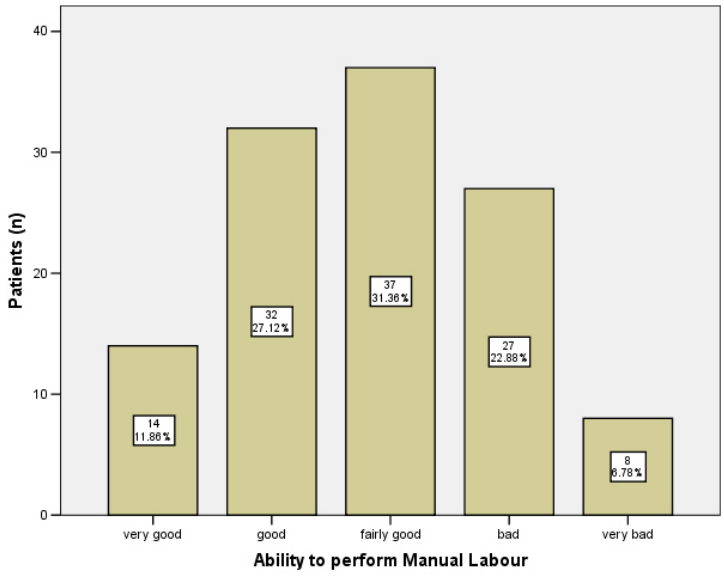


Figure 13: Ability to perform manual labour

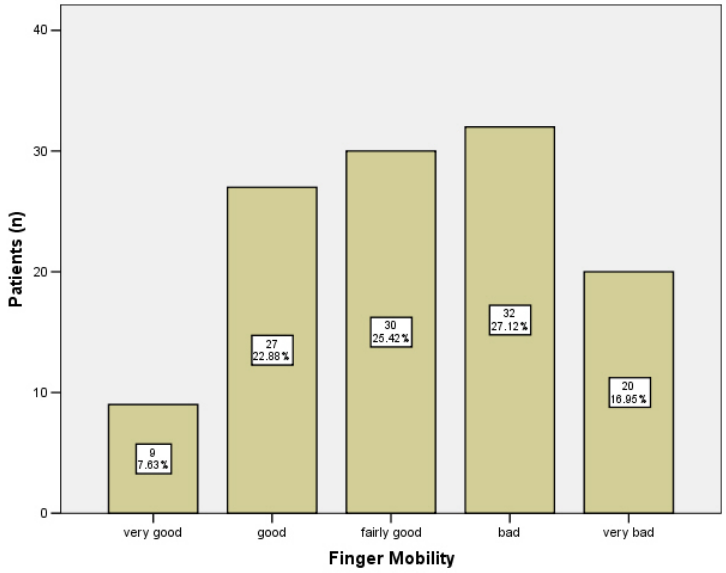


Figure 14: Finger mobility

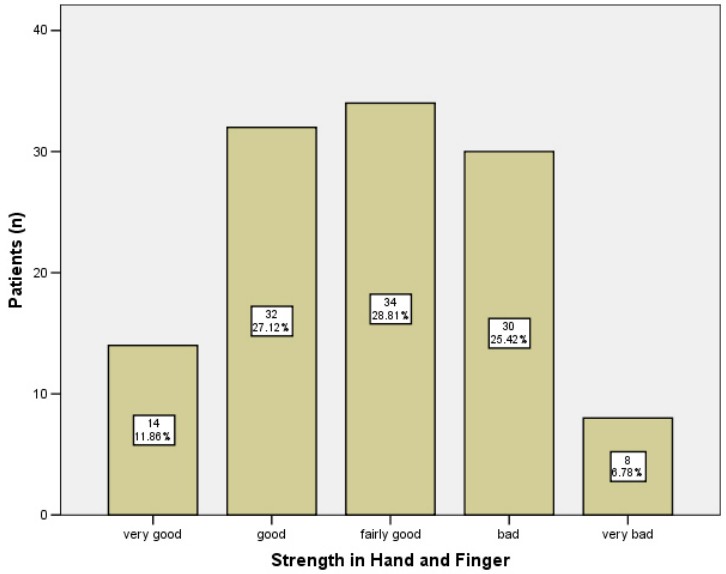


Figure 15: Strength in hand and finger

When analysing Figure 13 and 15, it can be seen that the ability to perform manual labour and strength in hand and finger are almost identical. This clearly indicates that power motor recovery is required for manual labour. Figure 14, representing finger mobility, is similar, but has more patients in the `bad` and `very bad` category. Graphic representation (Figure 16) of global finger sensory recovery shows that most patients categorized themselves around the central three options.

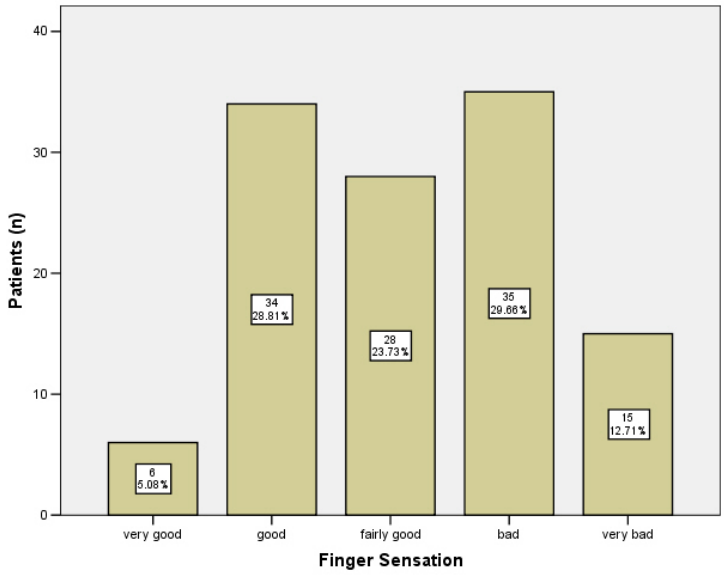


Figure 16: Finger sensation

Analysing these four questions with regards to the four treatment groups, a statistical significance could be calculated for manual labour and finger strength, using a Kruskal -Wallis - Chi - Square - Test (manual labour: Chi - Square = 11.08; p = 0.011; strength in hand and finger: Chi - Square = 10.58; p = 0.014).
The two variables (manual labour and strength in hand and finger) have been presented in more detail in Figure 17 and 18. It can be noted, that the y - axis on these two graphs are expressed in percentages, so the bar indicates the percentage reporting the spectrum `very good` to `very bad` for that group. This was done in order to give equal weight to groups with uneven patient numbers.

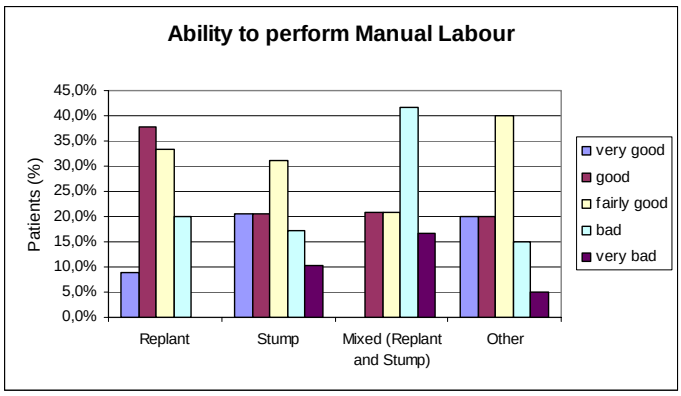


Figure 17: Ability to perform manual labour compared between treatment groups

20 % of the Other Group and 20.7 % from the Stump Group answered with `very good` and `good` with regards to the ability to perform manual labour. From the Replant Group, 8.9 % of patients answered with `very good` and 37.8 % with `good`. None of the Mixed Group patients answered with `very good`.

The treatment group that responded with `very bad` the most was the Mixed Group (16.7 %), followed by the Stump Group (10.3 %) and the Other Group (5 %). No patients in the Replant Group responded with very bad.

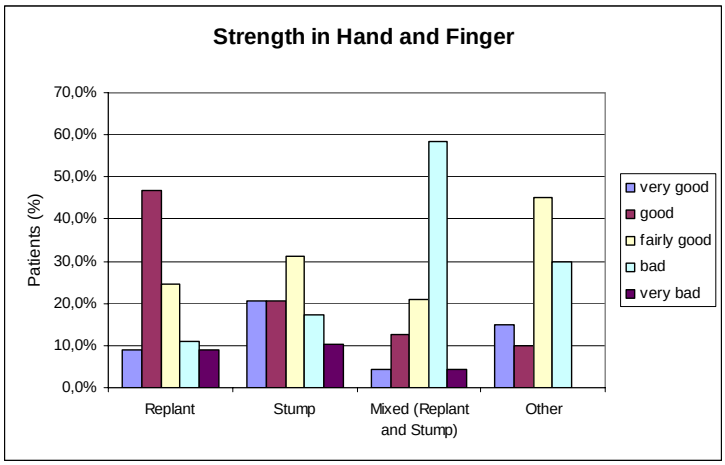


Figure 18: Strength in Hand and Finger compared between treatment groups

The greatest number of patients judged their strength in hand and finger as fairly good (28.8 %). Regarding the response to strength in hand and finger across the four treatment groups (Figure 18), a greater percentage of patients in the Replant Group (46.7 %) described their finger strength as `good` and 58.3 % of the Mixed Group described their finger strength as `bad`. It is interesting to note that most of the patients who reported their finger strength as `very good` came from the Stump Group (20.7 %), with only 4.2 % of the Mixed Group rating their finger strength in that category. Post - hoc pair wise comparisons of the four groups, using Mann - Whitney - U - Tests, showed for manual labour that the Mixed and Replant Group were significantly different from each other ($z = 3.28$; $p = 0.001$), the Mixed and Stump Group ($z = 2.29$; $p = 0.022$), as well as the Mixed and Other Groups ($z = 2.51$; $p = 0.012$). The pair wise comparisons revealed for strength in hand and finger that the Mixed and Replant Group were significantly different from each other ($z = 3.15$; $p = 0.002$), the Mixed and Stump Group ($z = 2.24$; $p = 0.025$), as well as the Mixed and Other Group ($z = 1.99$; $p = 0.046$). No other pairs of groups were significantly different from each other. After Bonferroni correction for these six pair wise comparisons, only the difference between Mixed and Replant Groups remained significant for both manual labour and strength in hand and finger.

III.4.2 Sensory Disturbances, Cold Intolerance and Pain

Assessment of sensory disturbances and pain in the 118 patients is represented in the two bar graphs (Figure 19, 20).

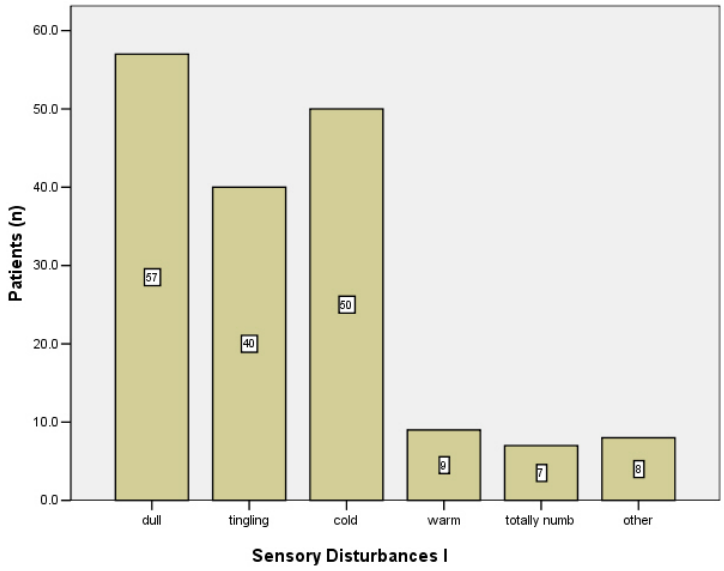


Figure 19: Sensory disturbances I

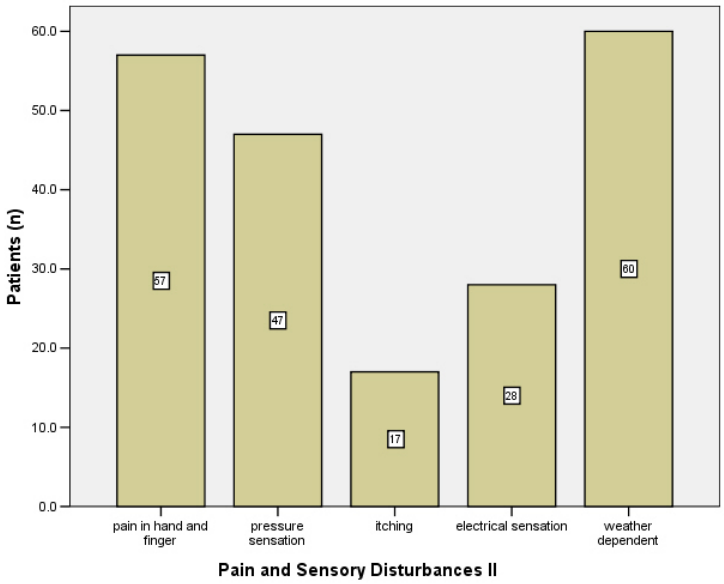


Figure 20: Pain and sensory disturbances II

It can be noted that sensory disturbances occurred as follows in decreasing frequency: Weather dependent discomfort (60 patients) > pain (57 patients); dull (57 patients) > cold (50 patients) > pressure (47 patients) > tingling (40 patients) > electrical sensation (28 patients) > itching (17 patients) > warm (9 patients) > totally numb (7 patients). The different variables of abnormal sensations and pain across the four treatment groups are represented in the following two graphs (Figure 21, 22). The y -

axis is expressed in percentage of each treatment group that answered in the affirmative to the dichotomous sensory disturbances variables.

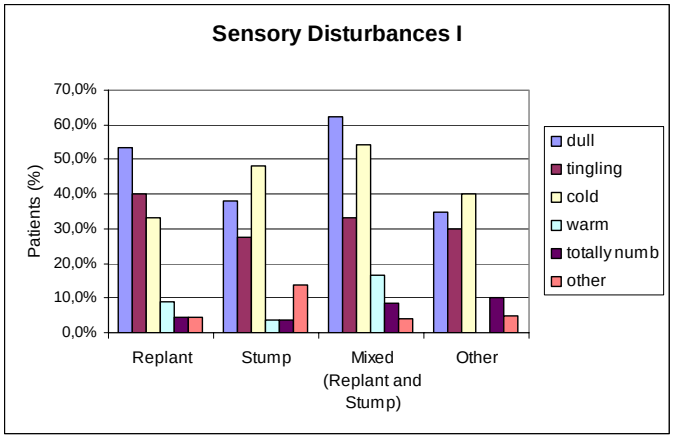


Figure 21: Sensory disturbances I compared between treatment groups

A low percentage in all four treatment groups experienced abnormal warm sensations, totally numb digits, and other abnormal sensations. A higher percentage (> 25 %) in each group reported dull, tingling and cold sensations.

The issue of cold intolerance is important and had been addressed in the questionnaire in two ways. A yes / no - question, inquiring about cold sensations and a 5 - point Likert - Scale question, asking patients to rate the severity of their cold intolerance. Answering the dichotomous question, 50 of the 118 patients (42.4 %) complained of cold sensations (Figure 19). Subdivision into the four treatment groups revealed that cold sensations were experienced as follows: Mixed Group (54.2 %) > Stump Group (48.3 %) > Other Group (40 %) > Replant Group (33.3 %). This should be interpreted in conjunction with the cold intolerance Likert - Scale response (Figure 23).

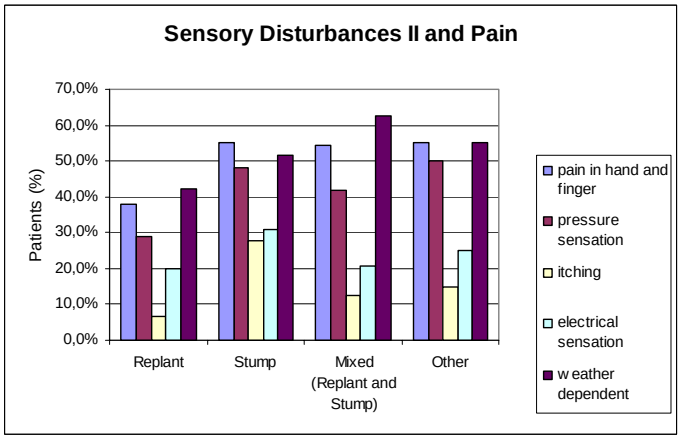


Figure 22: Sensory disturbances II and pain compared between treatment groups

Of the 118 patients, the greatest number of patients, sixty (50.8 %), had sensory disturbances which were weather dependent. Subdivision into the four treatment groups revealed a slightly higher percentage of the Mixed Group (62.5 %), stating that they had weather dependent problems: Mixed Group (62.5 %) > Other Group (55 %) > Stump Group (51.7 %) > Replant (42.2 %).
A Pearson - Chi - Square analysis was carried out to assess whether the presence of specific sensations differed significantly over the treatment groups. However, with $p > 0.05$ for all sensations, there was no statistically significant difference between the treatment groups in terms of the distribution of abnormal sensations.

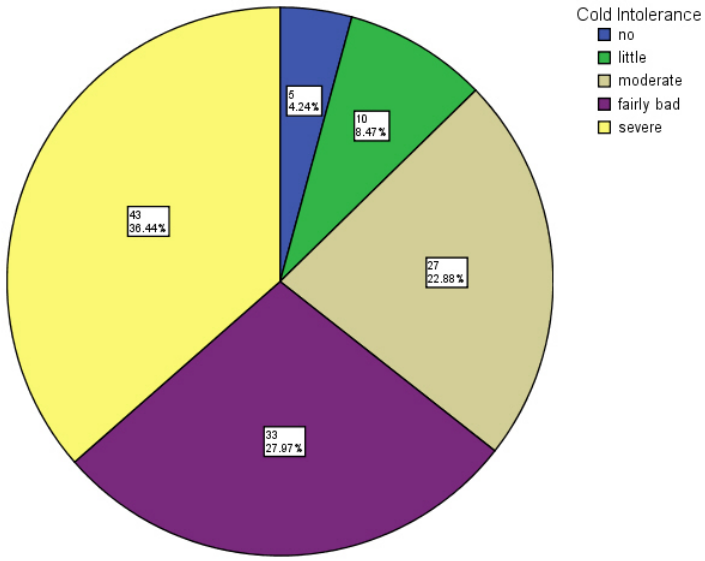


Figure 23: Cold intolerance

Assessing cold intolerance separately on a 5 - point Likert - Scale (Figure 23), a high percentage (95.8 %) stated that they were sensitive to cold temperatures. 103 patients (87.3 %) described moderate cold intolerance or worse.
Analysing cold intolerance across the four treatment groups (Table 8; Figure 24), severe cold intolerance was highest in the Mixed Group (45.8 %). In all groups, over 50 % of patients rated their cold intolerance worse than moderate: Mixed Group (75 %) > Stump Group (65.5 %) > Replant Group (62.2 %) > Other Group (55 %).
A Kruskal - Wallis - Chi - Square - Test (Chi - Square = 2.05; $p = 0.561$) indicated that the distribution of cold intolerance did not differ significantly between the four groups.

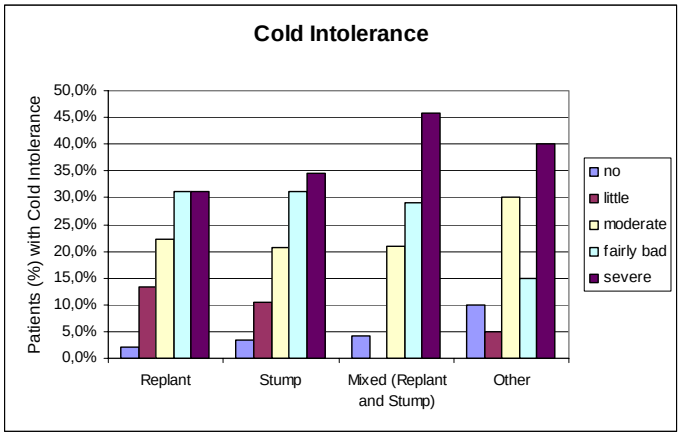


Figure 24: Cold intolerance compared between treatment groups

| | | Treatment Groups | | | | |
|---|---|---|---|---|---|---|
| | | Replant | Stump | Mixed (Replant and Stump) | Other | Total |
| Cold Intolerance | no | 1 (2.2 %) | 1 (3.4 %) | 1 (4.2 %) | 2 (10 %) | 5 (4.2 %) |
| | little | 6 (13.3 %) | 3 (10.3 %) | 0 (0 %) | 1 (5 %) | 10 (8.5 %) |
| | moderate | 10 (22.2 %) | 6 (20.7 %) | 5 (20.8 %) | 6 (30 %) | 27 (22.9 %) |
| | fairly bad | 14 (31.1 %) | 9 (31 %) | 7 (29.2 %) | 3 (15 %) | 33 (28 %) |
| | severe | 14 (31.1 %) | 10 (34.5 %) | 11 (45.8 %) | 8 (40 %) | 43 (36.4 %) |
| Total | | 45 (100 %) | 29 (100 %) | 24 (100 %) | 20 (100 %) | 118 (100 %) |

Table 8: Cold intolerance compared between treatment groups

Pain had been analysed in two ways: A yes / no - question, inquiring about its presence and a 5 - point Likert - Scale question, asking patients to rate the frequency of the pain experienced. The following was found: Nearly half of the 118 patients experienced pain (48.3 %). 22 patients suffered pain less than once a week, 17 more than once a week, and 18 had daily pain.

| | | Treatment Groups | | | | |
|---|---|---|---|---|---|---|
| | | Replant | Stump | Mixed (Replant and Stump) | Other | Total |
| Frequency of Pain | no pain | 28 (62.2 %) | 13 (44.8 %) | 11 (45.8 %) | 9 (45 %) | 61 (51.7 %) |
| | less than once a week | 6 (13.3 %) | 8 (27.6 %) | 4 (16.7 %) | 4 (20 %) | 22 (18.6 %) |
| | more than once a week | 7 (15.6 %) | 3 (10.3 %) | 1 (4.2 %) | 6 (30 %) | 17 (14.4 %) |
| | daily | 4 (8.9 %) | 5 (17.24 %) | 8 (33.3 %) | 1 (5 %) | 18 (15.3 %) |
| | | 45 (100 %) | 29 (100 %) | 24 (100 %) | 20 (100 %) | 118 (100 %) |

Table 9: Frequencies of pain

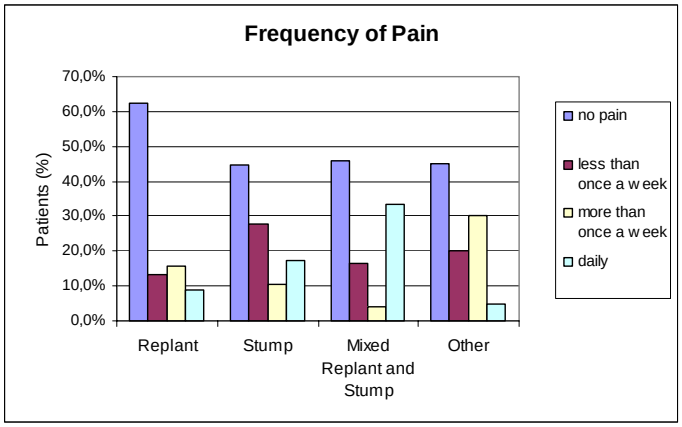


Figure 25: Frequencies of pain

Pain was present most in the Stump Group (55.2 %), and least in the Replant Group (37.8 %). The Mixed Group suffered daily pain most frequently (33.3 %). A Kruskal - Wallis - Chi - Square - Test (Chi - Square = 3.45; p = 0.327) indicated that the frequency of pain did not differ significantly between the treatment groups.
The final analysis in this section was to relate the dichotomous sensory disturbances and pain questions to the HISS. As can be seen from Table 10, there was no evidence that specific sensory disturbances or pain were related to the HISS, as all the p - values are above 0.05.

| | ***Yes*** | ***No*** | ***t (p-value)*** |
|---|---|---|---|
| dull | 226.2 (126.3) | 192.9 (123.5) | 1.45 (0.151) |
| tingling | 217.4 (125.2) | 204.6 (126.4) | 0.52 (0.603) |
| cold | 216.5 (127.4) | 203.4 (125.0) | 0.56 (0.576) |
| warm | 285.5 (174.0) | 202.6 (119.7) | 1.41 (0.194) |
| totally numb | 216.3 (148.7) | 208.5 (124.8) | 0.16 (0.874) |
| other | 184.9 (127.7) | 210.7 (125.9) | 0.57 (0.595) |
| pain | 219.4 (119.8) | 200.3 (131.1) | 0.82 (0.412) |
| pressure | 220.9 (130.4) | 201.5 (123.0) | 0.82 (0.410) |
| itching | 191.0 (102.5) | 212.3 (129.5) | 0.64 (0.521) |
| electric sensation | 223.3 (117.0) | 204.8 (128.7) | 0.67 (0.500) |
| weather dependent | 223.7 (120.6) | 194.2 (130.3) | 1.28 (0.204) |

Table 10: Hand Injury Severity Scores [mean (Std)] for sensory disturbances I and II and pain

### III.4.3 Satisfaction with Operation - Result

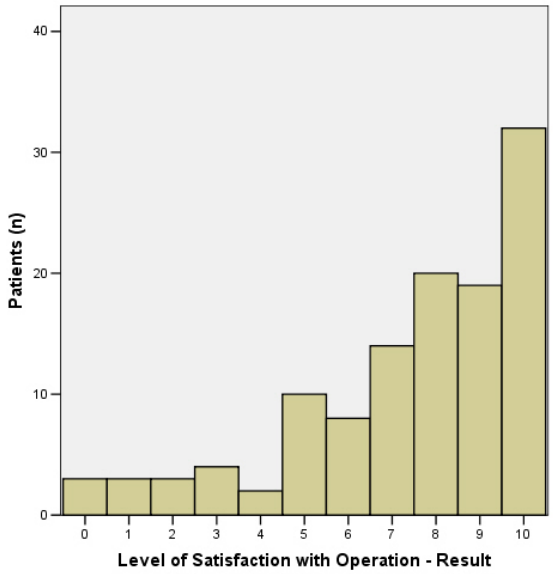


Figure 26: Level of satisfaction with operation - result

Patients rated their level of satisfaction with the surgical result on a 10 - point scale. Figure 26 shows their response graphically. 3 patients (2.5 %) expressed extreme dissatisfaction by circling `0` on the scale. A total of 15 patients (12.7 %) rated their satisfaction below `5`. 103 patients (87.3 %) chose `5` or higher on the scale. 27.1 % of the 118 patients were extremely satisfied and reported 10.

Level of satisfaction with the surgical results had been further analysed by division into the four treatment groups (Figure 27; Table 11).

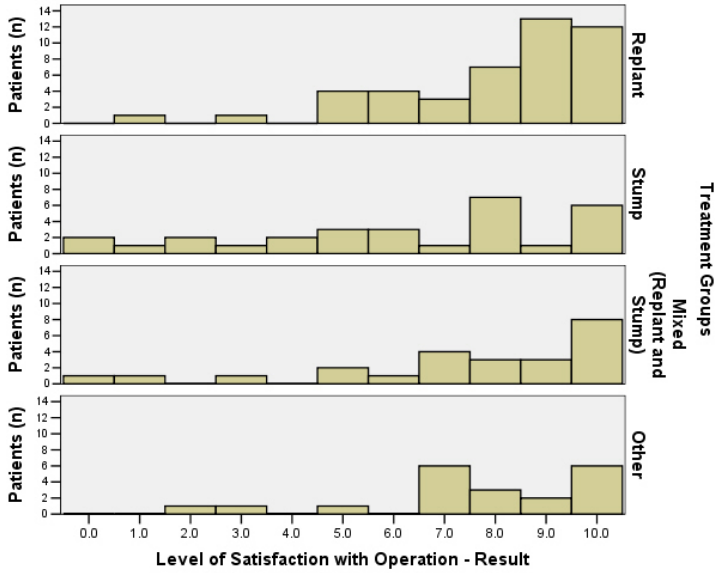


Figure 27: Level of satisfaction with operation result compared between treatment groups

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Replant | 45 | 8.044 | 2.0775 | 1.0 | 10.0 |
| Stump | 29 | 6.241 | 3.1697 | .0 | 10.0 |
| Mixed (Replant and Stump) | 24 | 7.458 | 2.8889 | .0 | 10.0 |
| Other | 20 | 7.700 | 2.2965 | 2.0 | 10.0 |
| Total | 118 | 7.424 | 2.6519 | .0 | 10.0 |

Table 11: Level of satisfaction with operation result compared between treatment groups

The Replant Group appeared the most satisfied with their surgery. Their mean rating was the highest (8.0 out of 10). The Stump Group was the least satisfied with a mean rating of 6.2 out of 10. The total sample had a mean rating of 7.4 out of 10 with regards to their level of satisfaction with the operation result.

Using one - way analysis of variance, a statistically significant difference in the level of satisfaction with the operation result could be demonstrated ($F = 2.96$, $p = 0.035$). Pair wise comparisons indicated that only the level of satisfaction between the Replant and Stump Group differed significantly ($p = 0.025$).

This finding can be possibly explained by the satisfaction with the final result, i.e. restoration of anatomical continuity. The Stump Group is the least satisfied group, although their mean HISS (226.3) was much lower than the severity of injuries from the Mixed Group (337.8). Patients from both the Mixed and the Stump Group had terminalizations performed. The Mixed Group is more likely to be satisfied, because there was a measure of reconstructive success in this group with some replanted digits surviving.

### III.4.4 Work related Aspects

When asked about the length of work disability following their hand injury, 97 of the 118 patients answered. 21 patients did not complete this section of the questionnaire, explaining that they were pensioners (9), housewives (3), or pupils (9). The following results therefore relate only to 97 patients: 37 patients were work disabled for less than 3 months, 27 were for between 3 and 6 months, and 17 for between 6 and 12 months. 16 were work disabled for more than 12 months. 14 of these 16 patients were work disabled for up to 3 years and two 2 for 5 years.

The highest percentage of the patients, who were work disabled up to 3 months, were from the Other Group (50 %), followed by the Replant Group (44.4 %), then the Stump Group (40.9 %), and finally the Mixed Group (10.5 %). The group with the highest percentage of patients with work disability of more than 1 year was the Mixed Group (42.1 %), followed by the Stump Group (18.2 %), then the Other Group (10

%), and finally the Replant Group (5.6 %). 77.7 % of the Replant Group patients and 59.1 % of the Stump Group had a work disability under 6 months. 47.3 % of the Mixed Group were work disabled less than 6 months.

| | | Treatment group | | | | Total |
|---|---|---|---|---|---|---|
| | | Replant | Stump | Mixed (Replant and Stump) | Other | |
| Work Disability | < 3 months | 16 (44.4 %) | 9 (40.9 %) | 2 (10.5 %) | 10 (50 %) | 37 (38.1%) |
| | 3 - 6 months | 12 (33.3 %) | 4 (18.2 %) | 7 (36.8 %) | 4 (20 %) | 27 (27.8%) |
| | 6 - 12 months | 6 (16.7 %) | 5 (22.7 %) | 2 (10.5 %) | 4 (20 %) | 17 (17.5%) |
| | > 12 months | 2 (5.6 %) | 4 (18.2 %) | 8 (42.1 %) | 2 (10 %) | 16 (16.5%) |
| Total | | 36 (100 %) | 22 (100 %) | 19 (100 %) | 20(100 %) | 97 (100 %) |

Table 12: Length of work disability compared between treatment groups

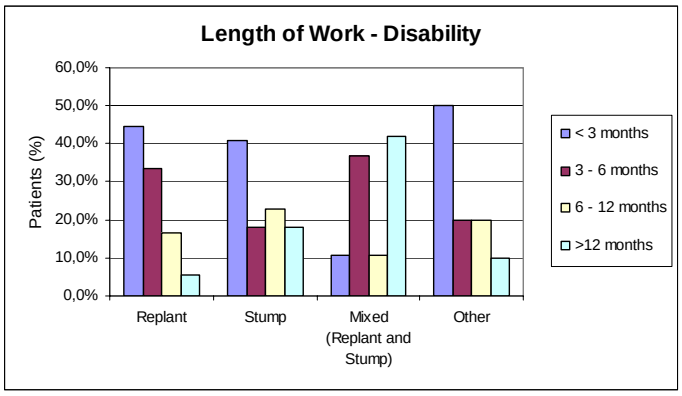


Figure 28: Length of work disability compared between treatment groups

The difference between the four treatment groups was analysed with a Fishers - Exact - Test. This revealed that the distribution of length of work disability differs between the treatment groups significantly (Fishers Exact Test = 17.84; p = 0.029).
Comparing each of the four groups, the Mixed Group differed significantly from both the Replant (Fishers Exact Test = 13.28; p = 0.003) and the Other Group (Fishers Exact Test = 10.24; p 0.013) No other pairs of groups were significantly different from each other. After Bonferroni correction for multiple pair wise comparisons, only the significance between the Mixed and Replant Group remained.
Patients in the Mixed Group are therefore taking the longest to return to work.
Those that returned to work within 6 months were mainly from the Replant and the Other Group, with probably more from the Replant Group going back to work.

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| < 3 months | 37 | 150.4 | 75.45 | 51.0 | 390.0 |
| 3 - 6 months | 27 | 198.6 | 111.78 | 72.0 | 492.0 |
| 6 - 12 months | 17 | 247.5 | 158.1 | 60.0 | 704.0 |
| > 12 months | 16 | 310.4 | 149.37 | 60.0 | 604.0 |
| Total | 97 | 207.2 | 128.45 | 51.0 | 704.0 |

Table 13: Length of work disability related to Hand Injury Severity Scores

Table 13 shows the descriptive statistics of HISS by length of time of work disability. One - way analysis of variance showed that the length of work disability of the 97 patients did differ significantly in their HISS scores ($F = 7.83$, $p < 0.001$).
Post - hoc pair wise comparisons indicated that HISS scores differed significantly between the more than 12 months group and the two shortest work disability groups, 0 - 3 months ($p < 0.001$) and 3 - 6 months ($p = 0.019$). However, the two shortest work disability groups did not differ from each other. The 6 to 12 month group differed significantly from the up to 3 months group, but not any other group ($p = 0.033$). Therefore, it can be said that people who were work disabled for more than 12 months had significantly more severe injuries than those who were work disabled for up to 3 months or between 3 and 6 months. The two shortest work disability groups had similar mean HISS scores to each other (150.4 and 198.6). The 6 - 12 months group had significantly more severe injuries than the up to 3 months group.

Employment status analysed those patients that were employed at the time of injury. 96 patients were employed when they injured their hand. One unemployed patient, who completed the section of work disability and work satisfaction in the questionnaire, stated that he was unemployed both at the time of injury and remained so after recovery. He claimed that his period of work disability was 3 - 6 months. This patient was excluded from the analysis of employment and income status.
84 (87.5 %) of the 96 patients had returned to work by 3 years. 12 patients did not return to work: 9 had retired during rehabilitation. 3 patients remained unemployed. Analysis of the question, how many patients went back to the same employment revealed that 61 (63.5 %) of the 96 patients returned to their pre - injury work place full time and 18 (18.8 %) did so part time. 5 (5.2 %) patients found a different type of employment.

The effect of the hand injury on the patients` income was as follows: 71 patients had the same income after their injury, 11 had a slightly reduced income and 5 had a drastically reduced income after their injury, including the 3 patients, who remained unemployed after their recovery, receiving only state - unemployment - benefit.

82 people of the 118 patients responded, when asked how satisfied they are with their present job situation. This question was not applicable to 36 patients, as 6 further patients had retired by the time of filling in the questionnaire.
Work satisfaction was expressed on a 10 - point scale. (Mean = 7; Median = 8; Std = 3.04). It can be seen (Figure 29) that the distribution is negatively skewed. It should, however, be noted that there is a minor peak at 0. Four of these 7 patients, who were very dissatisfied with their present work situation, were people who were unemployed at the time they filled in the questionnaire.

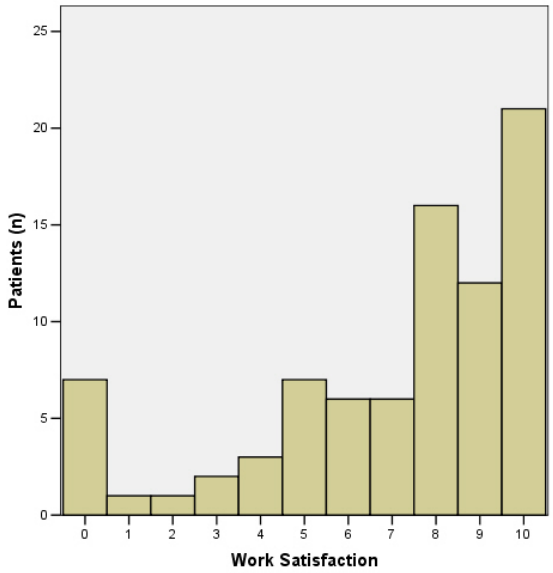


Figure 29: Level of satisfaction with present work situation

Subdividing the present work satisfaction into the four treatment groups, one can see that the Replant Group (mean = 8.4) was the most satisfied with their present work situation. The Mixed Group (mean = 5.0) was the least satisfied and the Other Group (mean = 6.9) and Stump (mean = 6.8) were in between.

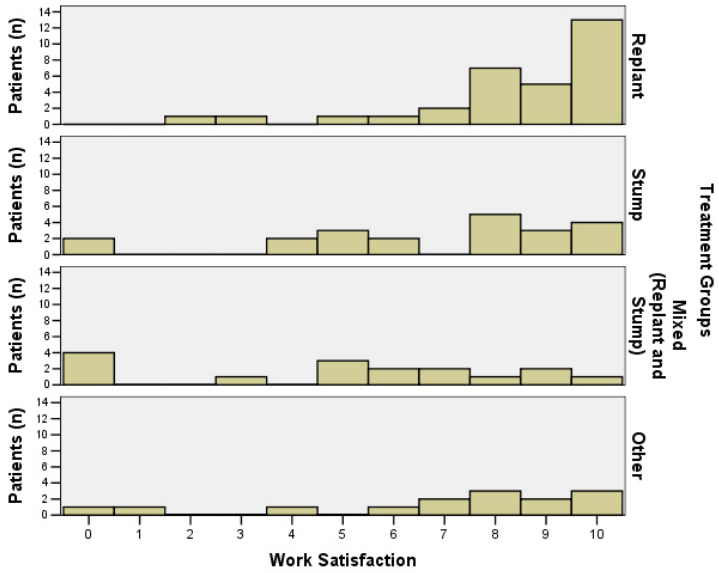


Figure 30: Level of satisfaction with present work situation compared between treatment groups

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Replant | 31 | 8.4 | 2.06 | 2 | 10 |
| Stump | 21 | 6.8 | 3.02 | 0 | 10 |
| Mixed (Replant and Stump) | 16 | 5.0 | 3.46 | 0 | 10 |
| Other | 14 | 6.9 | 3.20 | 0 | 10 |
| Total | 82 | 7.1 | 3.04 | 0 | 10 |

Table 14: Level of satisfaction with present work situation compared between treatment groups

One - way analysis of variance showed that the 4 treatment groups differed significantly in the level of satisfaction with their present work situation ($F = 5.32$; $p = 0.002$). Post - hoc pair wise comparisons indicate that the job satisfaction differed only significantly between the Mixed Group and the Replant Group ($p = 0.001$).

### III.4.5 Spare Time Activities

The impact of the hand injuries on the patients` spare time activities was assessed using a 5 - point Likert - Scale question and a dichotomous yes / no - question of whether any activities had to be given up. The patients were then asked to state which spare time activity or hobby they were unable to do.

From 118 patients, 10 (8.5 %) stated that their injury had a `very` big impact on their spare time activities. 13 (11.0 %) patients answered with `fairly` and 19 (16.1 %) with `moderate`. In 37 (31.4 %) patients, the hand injury had `little` influence and in 39 (33.1%) `no` influence at all on the spare time activities.

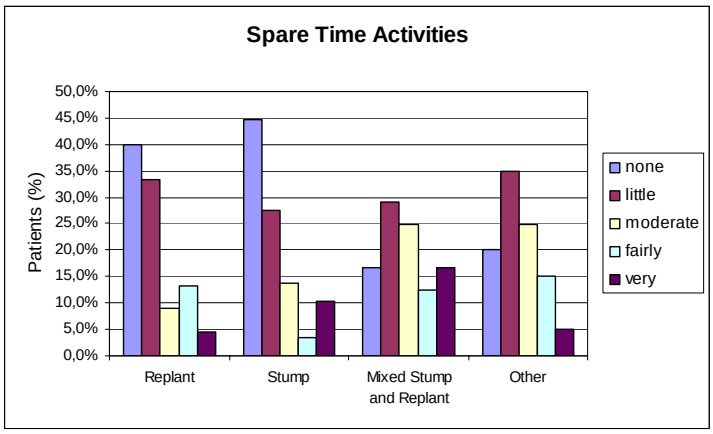


Figure 31: Impact on spare time activities across treatment groups

A Kruskal - Wallis - Chi - Square - Test indicated that the treatment groups differed in terms of the degree to which their injury influenced their spare time activities (Chi - Square = 8.16; p = 0.043). Pair wise comparisons of the treatment groups using Mann -Whitney - Tests indicated that the Mixed Group had reported their injury as having significantly more influence on their spare time activities than both the Replant Groups (z = 2.36; p = 0.019) and the Stump Group (z = 2.25; p = 0.025). However, after Bonferroni correction, these comparisons were therefore no longer significant.

44 (37.3 %) patients had to give up a certain spare time activity because of the hand injury. The response across the four treatment groups can be seen in Table 15.

| | | Treatment Groups | | | | |
|---|---|---|---|---|---|---|
| | | Replant | Stump | Mixed (R / S) | Other | Total |
| Did you have to stop a spare time activity because of injury? | Yes | 9 (20 %) | 9 (31 %) | 17 (70.8 %) | 9 (45 %) | 44 (37.3 %) |
| | No | 36 (80 %) | 20 (69 %) | 7 (29.2 %) | 11 (55 %) | 74 (62.7 %) |
| | Total | 45 (100 %) | 29 (100 %) | 24 (100 %) | 20 (100 %) | 118 (100 %) |

Table 15: Spare time activities abandoned

Pearson - Chi - Square analysis showed that there is a statistically significant difference between the four treatment groups in terms of whether they had to stop a spare time activity because of their injury or not (Chi - Square = 18.28; $p < 0.001$).

It can be seen that a much higher percentage of the Mixed Group, 70.8 %, had to stop their spare time activities in comparison to the other three groups. The Replant Group had to give up their hobbies in only 20 %. Inter - group individual comparisons

revealed, the Mixed Group was significantly different from both the Replant (Chi - Square = 17.22; $p < 0.001$) and the Stump Group (Chi - Square = 8.32; $p = 0.004$). The Replant differed also significantly from the Other Group (Chi - Square = 4.32; $p = 0.038$). After Bonferroni correction, the Mixed and Replant Groups as well as the Mixed and Stump Group difference remained significant.

31 patients had to give up one spare time activity. 10 people had to give up two spare time activities, and 3 patients had to give up three spare time activities and Looking at the type of hobbies, the study group had to give up, 10 people had to give up playing an instrument, 15 patients gave up a craft - hobby, and 29 stopped playing sport. 6 patients gave up an `other` spare time activity.

### III.4.6 Analyses of Outcome Questionnaires

#### *III.4.6.1 Disability of the Arm, Shoulder and Hand (DASH)*

For the 118 patients, the mean DASH score was 20.2 (Std = 21.3; Median = 12.9; range = 0 - 100). The histogram is skewed to the left, indicating the majority of patients had DASH - scores at the lower end of the spectrum, i.e. have low disability.

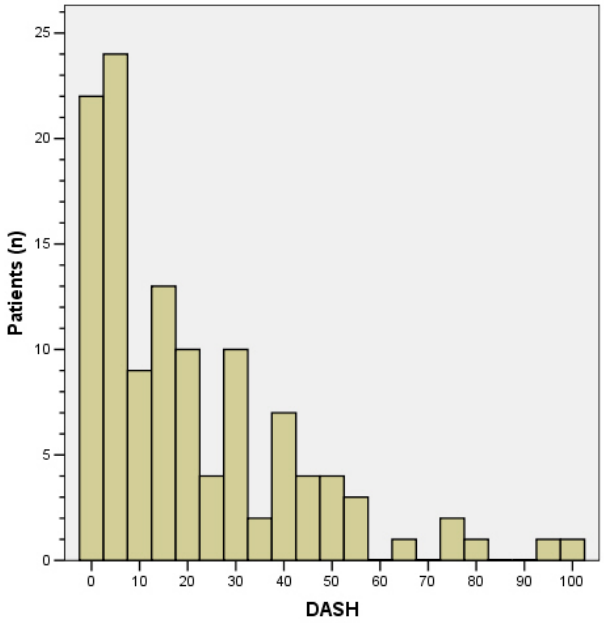


Figure 32: DASH

In Table 16, the DASH had been related to nine items in the left column (gender, marital status, etc.). The DASH measure was analysed using the non - parametric Mann - Whitney - U - Test or Kruskal - Wallis - Test. Mann - Whitney - U - Tests were used when two groups were compared, e.g. gender. Kruskal - Wallis - Tests were used when more than two groups were compared, e.g. marital status. As the variable was skewed, the median, minimum and maximum values were given.

| *Variable* | *Label* | *n* | *Median (Min / Max)* | *Mann - Whitney (z - approximation ) / Kruskal - Wallis value (p - value)* |
|---|---|---|---|---|
| Gender | Male | 103 | 12.5 (0 – 100) | 1.82 (0.069) |
| | Female | 15 | 24.2 (2.5 – 76.7) | |
| Hand dominance | Right | 107 | 13.3 (0 – 100) | 0.41 (0.684) |
| | Left | 11 | 11.7 (0 – 76.7) | |
| Marital status | Single | 33 | 11.7 (0 – 52.5) | 4.90 (0.086) |
| | Married | 78 | 12.9 (0 – 100) | |
| | Widowed / separated | 7 | 30.8 (3.3 – 76.7) | |
| Level of education | No school qualification or Hauptschulabschluß | 77 | 13.3 (0 – 100) | 5.02 (0.171) |
| | Realschulabschluß | 23 | 16.7 (0 – 65.8) | |
| | Fachhochschulreife | 7 | 6.9 (0 – 43.3) | |
| | Abitur | 11 | 5 (0 – 44.7) | |
| Highest work qualification | Abgeschlossene Lehre | 68 | 15 (0 – 100) | 13.47 (0.036) |
| | Handelsschule | 3 | 40.8 (32.5 – 51.7) | |
| | Fachschulabschluß | 18 | 9.6 (0 – 40) | |
| | Fachhochschulabschluß | 7 | 6.7 (0 – 43.3) | |
| | Universitätsabschluß | 9 | 5.8 (0 – 65.8) | |
| | Still in professional training | 3 | 0.83 (0 – 30.8) | |
| | No / other job qualification | 10 | 32.5 (1.7 – 94.2) | |
| Employment status after injury | Stayed the same | 61 | 6.7 (0 – 65.8) | 21.52 (<0.001) |
| | Partly changed | 18 | 35.4 (3.3 – 53.3) | |
| | Changed completely | 9 | 32.5 (0 - 100) | |
| Level of income after injury | Drastically reduced | 6 | 61.5 (32 – 100) | 17.32 (<0.001) |
| | Partly reduced | 11 | 16.7 (5.8 – 45.8) | |
| | Same | 71 | 9.2 (0 –65.8) | |
| Treatment Groups | Replant | 45 | 6.7 (0 – 65.8) | 12.39 (0.006) |
| | Stump | 29 | 14.2 (0 – 94.2) | |
| | Mixed (R / S) | 24 | 35 (0 – 100) | |
| | Other | 20 | 12.1 (0 – 51.7) | |
| Time since injury | Less than 3 years | 24 | 19.6 (0 – 52.5) | 1.24 (0.216) |
| | 3 years or more | 94 | 12.5 (0 – 100) | |

Table 16: DASH - Analysis I

A statistically significant difference in the distribution of DASH scores had been found in the analysis of the following groups: Highest work qualification ($p = 0.036$), employment status after injury ($p < 0.001$), level of income after injury ($p < 0.001$), and the four treatment groups ($p = 0.006$). As nine different variables were tested, a lower level of significance had to be used. A Bonferroni corrected significance level was $0.05/9 = 0.006$ (to 3 decimal places). After correction, the groups of employment status and income level as well as the four treatment groups still showed significantly different DASH scores. This adjustment for multiple testing was also applied for the other questionnaires (HADS, BDDE - SR, FLZ, FBeK).

**Employment status after injury:** Patients, who had to partly or completely change their work status after their hand injury, had higher DASH scores.

**Level of income after injury:** Patients, who had their income drastically reduced after the injury, had higher DASH scores.

**Four treatment groups:** The Mixed Group had the highest DASH scores. Pair wise comparisons showed that the Mixed was significantly different from the other three groups. (Replant: $p = 0.001$; Stump: $p = 0.018$; Other: 0.023) The Mixed and Replant Groups differed significantly also after Bonferroni adjustment.

| | ***Yes*** | ***No*** | ***Mann - Whitney (z approximation) (p - value)*** |
|---|---|---|---|
| | ***Median (Min / Max)*** | ***Median (Min / Max)*** | |
| dull | 17.5 (0 – 76.7) | 6.7 (0 – 100) | 2.68 (0.007) |
| tingling | 16.3 (0 – 94.2) | 12.5 (0 – 100) | 1.61 (0.107) |
| cold | 22.1 (1.7 – 100) | 7.9 (0 – 65.8) | 3.57 (<0.001) |
| warm | 12.5 (0 – 100) | 13.3 (0 – 94.2) | 0.00 (1.00) |
| totally numb | 40 (30 – 100) | 12.5 (0 – 94.2) | 3.14 (0.002) |
| other | 15.4 (0 – 38.2) | 12.5 (0 – 100) | 0.89 (0.374) |
| pain | 30.8 (1.67 – 100) | 4.2 (0 – 50) | 6.63 (<0.001) |
| pressure | 25.8 (0 – 100) | 6.7 (0 – 79.2) | 4.23 (<0.001) |
| itching | 19.2 (1.67 – 76.7) | 11.7 (0 – 100) | 2.22 (0.027) |
| electrical sensation | 13.8 (0 – 94.2) | 12.9 (0 – 100) | 0.19 (0.869) |
| weather dependent | 19.6 (0 – 100) | 5.8 (0 – 53.3) | 4.28 (<0.001) |

Table 17: DASH - Analysis II

The following sensory disturbances had significantly higher DASH scores than those, who did not have the sensation: Dull ($p = 0.007$), cold ($p < 0.001$), totally numb ($p = 0.002$), pressure ($p < 0.001$), itching ($p = 0.027$) and weather dependency ($p < 0.001$). Patients, who experienced pain, had significantly higher DASH scores ($p < 0.001$). As eleven different sensory disturbances are being tested, a lower level of significance should be used. A Bonferroni corrected significance level is 0.05/11 = 0.005 (to 3 decimal places). After correction, the following sensory disturbances remained significant: Cold, numb, pressure, weather dependency and pain. This adjustment for multiple testing will also be applied for the other questionnaires (HADS, BDDE - SR, FLZ, FBeK).

### *III.4.6.2 DASH - Sports / Performing Arts (Optional Module)*

This outcome questionnaire was only applicable to 96 patients. For this group of patients, the mean score was 30.9 (Std = 33.0; median = 18.8; range = 0 - 100). The histogram is skewed to the left, which shows that the majority of patients had DASH scores at the lower end of the spectrum, i.e. low disability.

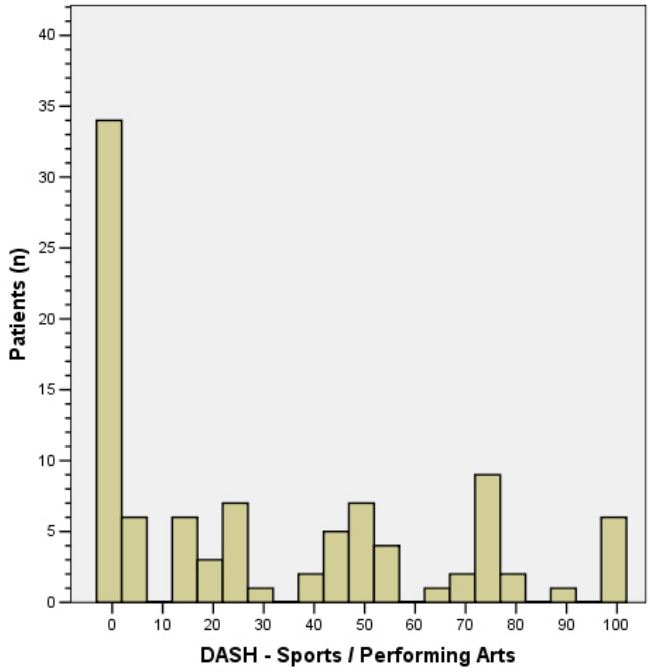


Figure 33: DASH - Sports / Performing Arts

Statistical analysis was carried out, using Mann - Whitney - U - or Kruskal - Wallis - Tests, as appropriate. The DASH (optional module) had been related to same nine items. As the variable was skewed the median, minimum and maximum values were given.

| *Variable* | *Label* | *n* | *Median (Min / Max)* | *Mann - Whitney (z - approximation) / Kruskal-Wallis value (p - value)* |
|---|---|---|---|---|
| Gender | Male | 83 | 12.5 (0 – 100) | 2.92 (0.004) |
| | Female | 13 | 50.0 (6.25 – 50.0) | |
| Hand dominance | Right | 85 | 18.8 (0 – 100) | 0.45 (0.654) |
| | Left | 11 | 25.0 (0 – 76.7) | |
| Marital status | Single | 30 | 9.4 (0 – 100) | 1.88 (0.390) |
| | Married | 61 | 25.0 (0 – 100) | |
| | Widowed / separated | 5 | 50.0 (0 – 100) | |
| Level of education | No school qualification / Hauptschulabschluß | 59 | 18.8 (0 – 100) | 4.99 (0.173) |
| | Realschulabschluß | 23 | 37.5 (0 – 100) | |
| | Fachhochschulreife | 6 | 0.0 (0 – 75) | |
| | Abitur | 8 | 6.3 (0 – 75) | |
| Highest work qualification | Abgeschlossene Lehre | 55 | 18.8 (0 – 100) | 11.38 (0.077) |
| | Handelsschule | 3 | 68.8 (50 – 81.3) | |
| | Fachschulabschluß | 17 | 12.5 (0 – 100) | |
| | Fachhochschulabschluß | 5 | 0 (0 – 43.8) | |
| | Universitätsabschluß | 7 | 12.5 (0 – 75) | |
| | Still in professional training | 3 | 0.0 (0 – 50) | |
| | No / other job qualification | 6 | 53.1 (0 - 100) | |
| Employment status after injury | Stayed the same | 54 | 6.3 (0 – 100) | 16.90 (<0.001) |
| | Partly changed | 14 | 59.4 (6.3 - 100) | |
| | Changed completely | 8 | 40.6 (0 - 100) | |
| Level of income after injury | Drastically reduced | 4 | 78.1 (50 – 100) | 10.44 (0.005) |
| | Partly reduced | 9 | 25.0 (6.25 - 100) | |
| | Same | 63 | 6.3 (0 – 100) | |
| Treatment Groups | Replant | 39 | 6.3 (0 – 100) | 5.95 (0.114) |
| | Stump | 23 | 25.0 (0 – 100) | |
| | Mixed (R / S) | 18 | 40.6 (0 – 100) | |
| | Other | 16 | 34.4 (0 – 100 | |
| Time since injury | Less than 3 years | 23 | 37.5 (0 – 81.3) | 1.31 (0.192) |
| | 3 years or more | 73 | 12.5 (0 – 100) | |

Table 18: DASH - Sports / Performing Arts - Analysis I

The groups that displayed a significant difference were: Gender ($p = 0.004$), employment status after injury ($p < 0.001$), and level of income after injury ($p = 0.005$). All these variables were still significant after Bonferroni correction.

**Gender:** Females have higher scores on the DASH - optional module.

**Employment status after injury:** Patients, who had to partly or completely change their employment status after injury, had higher scores on this module.

**Level of income after injury:** Patients, who had their income drastically reduced after injury, had higher scores on this DASH.

| | ***Yes*** | ***No*** | ***Mann - Whitney (z approximation) (p - value)*** |
|---|---|---|---|
| | ***Median (Min / Max)*** | ***Median (Min / Max)*** | |
| dull | 43.8 (0 – 76.7) | 9.4 (0 – 100) | 2.15 (0.032) |
| tingling | 21.9 (0 – 100) | 15.6 (0 – 100) | 0.66 (0.507) |
| cold | 50 (0 – 100) | 6.3 (0 – 100) | 3.32(0.001) |
| warm | 3.1 (0 – 100) | 21.9 (0 –100) | 0.38 (0.704) |
| totally numb | 68.8 (43.8 – 100) | 12.5 (0 – 100) | 2.48 (0.013) |
| other | 25 (0 – 75) | 18.8 (0 – 100) | 0.54 (0.592) |
| pain | 50 (0 – 100) | 0 (0 – 75) | 5.72 (<0.001) |
| pressure | 46.9 (0 – 100) | 6.3 (0 – 100) | 3.55 (<0.001) |
| Itching | 31.3 (0 – 100) | 12.5 (0 – 100) | 1.91 (0.056) |
| electrical sensation | 40.6 (0 – 100) | 15.6 (0 – 100) | 1.28 (0.201) |
| weather dependency | 43.8 (0 – 100) | 9.4 (0 – 100) | 3.20 (0.001) |

Table 19: DASH - Sports / Performing Arts - Analysis II

Patients with the following abnormal sensations have significantly higher DASH - sports / performing arts scores, than those without the specific sensation: Dull ($p = 0.032$), cold ($p = 0.001$), totally numb ($p = 0.013$), pressure ($p < 0.001$) and weather dependency ($p = 0.001$). Patients experiencing pain had significantly higher scores as well ($p < 0.001$). After Bonferroni adjustment, cold, pressure, weather dependency and pain remained significant.

*III.4.6.3 Hospital Anxiety Depression Score (HADS): Anxiety*

The anxiety scale was separately analysed from the depression scale, to allow independent analysis of each. For the 118 patients, mean HADS - Anxiety was 4.6 (Std = 4.46; Median = 3.5; range = 0 - 21).

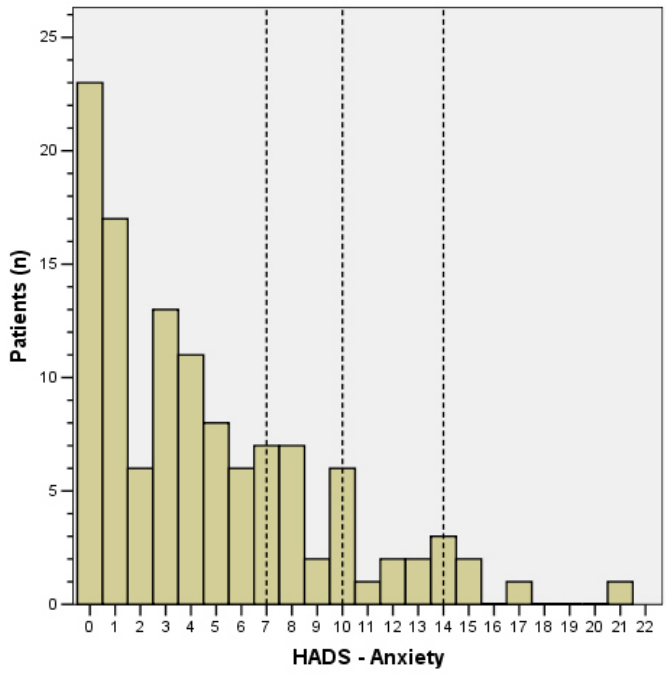


Figure 34: HADS - Anxiety

One can see that the variable `anxiety` is highly skewed to the left. The vertical dotted lines indicate the cut - off values. Four patients (3.4 %) scored 15 or above, i.e. they fell to the right of the third vertical dotted line. This means that these patients displayed severe anxiety when answering the HADS -questionnaire. A further 8 patients (6.8 %) scored 11 - 14, i.e. they fell between the second and the third vertical dotted line. These patients showed `probable` anxiety and therefore are considered to be an obvious `case` of psychological morbidity for the anxiety disorder. The group of 15 patients (12.7 %) between the left and the middle vertical dotted line, with a score between 8 and 10, represented the `borderline` group. Patients belonging in this category were considered to have a `possible` anxiety disorder. The largest group of patients fell to the left of the left vertical dotted line. These 91 patients (77.1 %) represented those without any anxiety and are considered within the `normal` spectrum (≤ 7).

Statistical analysis was carried out, using Mann - Whitney - U - or Kruskal - Wallis - Tests, as appropriate. In Table 20, the HADS - Anxiety had been related to the items in the left column. As the variable was skewed, the median, minimum and maximum values were provided.

| *Variable* | *Label* | *n* | *Median (Min / Max)* | *Mann - Whitney (z - approximation) / Kruskal -Wallis value (p - value)* |
|---|---|---|---|---|
| Gender | Male | 103 | 3 (0 – 21) | 2.58 (0.010) |
| | Female | 15 | 8 (0 – 15) | |
| Hand dominance | Right | 107 | 4 (0 – 21) | 0.17 (0.863) |
| | Left | 11 | 3 (0 – 15) | |
| Marital status | Single | 33 | 4 (0 – 10) | 3.41 (0.181) |
| | Married | 78 | 3 (0 – 21) | |
| | Widowed / separated | 7 | 10 (0 – 15) | |
| Level of education | No school qualification / Hauptschulabschluß | 77 | 4 (0 – 21) | 4.23 (0.237) |
| | Realschulabschluß | 23 | 3 (0 – 14) | |
| | Fachhochschulreife | 7 | 1 (0 – 5) | |
| | Abitur | 11 | 3 (0 -17) | |
| Highest work qualification | Abgeschlossene Lehre | 68 | 4 (0 – 21) | 9.21 (0.162) |
| | Handelsschule | 3 | 3 (1 – 13) | |
| | Fachschulabschluß | 18 | 3 (0 – 13) | |
| | Fachhochschulabschluß | 7 | 0 (0 – 5) | |
| | Universitätsabschluß | 9 | 3 (0 – 17) | |
| | Still in professional training | 3 | 0 (0 – 5) | |
| | No / other job qualification | 10 | 6.5 (0 – 15) | |
| Employment status after injury | Stayed the same | 61 | 3 (0 – 14) | 9.43 (0.009) |
| | Partly changed | 18 | 7 (0 – 14) | |
| | Changed completely | 9 | 4 (0 – 21) | |
| Level of income after injury | Drastically reduced | 6 | 13 (0 – 21) | 9.24 (0.010) |
| | Partly reduced | 11 | 4 (1 – 9) | |
| | Same | 71 | 3 (0 – 14) | |
| Treatment Groups | Replant | 45 | 3 (0 – 17) | 1.54 (0.674) |
| | Stump | 29 | 4 (0 – 15) | |
| | Mixed (R / S) | 24 | 4 (0 – 21) | |
| | Other | 20 | 4 (0 – 10) | |
| Time since injury | Less than 3 years | 24 | 3.5 (0 – 12) | 0.10 (0.920) |
| | 3 years or more | 94 | 3.5 (0 – 21) | |

Table 20: HADS - Anxiety - Analysis I

The groups that displayed a significant difference were: Gender (p = 0.010), employment status after injury (p = 0.009), and level of income after injury (p = 0.010). However, all these groups did not show significantly higher levels of anxiety after the correction.

| | ***Yes*** | ***No*** | ***Mann - Whitney (z approximation) (p - value)*** |
|---|---|---|---|
| | ***Median (Min / Max)*** | ***Median (Min / Max)*** | |
| dull | 4 (0 – 17) | 3 (0 – 21) | 0.72 (0.469) |
| tingling | 4 (0 – 17) | 3 (0 – 21) | 2.40 (0.016) |
| cold | 5 (0 – 21) | 3 (0 – 14) | 2.48 (0.013) |
| warm | 4 (0 – 21) | 3 (0 – 15) | 0.09 (0.927) |
| totally numb | 1 (0 – 21) | 4 (0 – 17) | 0.15 (0.881) |
| other | 4 (1 – 10) | 3 (0 – 21) | 0.85 (0.397) |
| pain | 7 (0 – 21) | 2 (0 – 14) | 4.28 (<0.001) |
| pressure | 5 (0 – 21) | 2 (0 – 14) | 3.39 (0.001) |
| itching | 7 (0 – 15) | 3 (0 – 21) | 2.68 (0.008) |
| electrical sensation | 6.5 (0 – 15) | 3 (0 – 21) | 2.01 (0.044) |
| weather dependent | 4.5 (0 – 21) | 3 (0 – 10) | 2.17 (0.030) |

Table 21: HADS - Anxiety - Analysis II

Patients with following sensory disturbances, displayed significantly higher levels of anxiety than those without that sensation: Tingling (p = 0.016), cold (p = 0.013), pressure (p = 0.001), itching (p = 0.008), electrical sensation (p = 0.044) and weather dependency (p = 0.030). Patients, who experienced pain, were more anxious (p < 0.001). However, only patients with pain (p < 0.001) and pressure sensations (0.001) showed significantly higher levels of anxiety after the correction for multiple testing.

*III.4.6.4 Hospital Anxiety Depression Score (HADS): Depression*

This HADS - outcome measure had been analysed in the same way as the anxiety component. The mean score was 3.6 (Std = 3.82; Median = 2; range = 0 - 16).

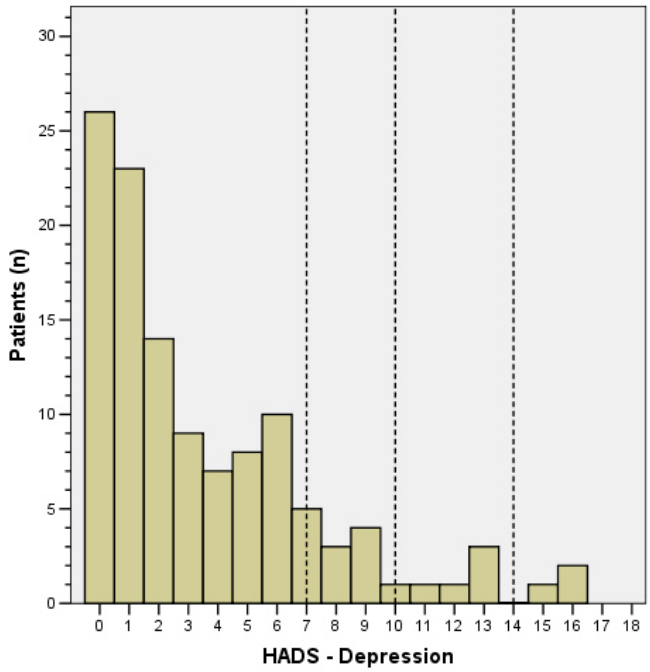


Figure 35: HADS - Depression

The histogram is highly skewed to the left. The vertical dotted lines indicate the cut - off values. The findings were very similar to the Anxiety component: The majority of patients, i.e. 102 patients (86.4 %), fell into the normal category. 8 patients (6.4%) scored 8 - 10 (borderline), 5 patients (4.2%) scored 11 - 14 (probable), and only 3 patients (2.5%) scored 15 or above (severe).

The distribution of levels of depression differed significantly between the degree to which someone`s employment status ($p = 0.007$) and income level ($p = 0.002$) had changed after injury. Only the groups for different level of income still showed significantly different levels of depression after the correction.

**Level of income after injury:** Patients, whose income has been drastically reduced after hand injury, have the highest level of depression.

| *Variable* | *Label* | *n* | *Median (Min / Max)* | *Mann - Whitney (z - approximation) / Kruskal -Wallis value (p - value)* |
|---|---|---|---|---|
| Gender | Male | 103 | 2 (0 – 16) | 1.86 (0.063) |
| | Female | 15 | 4 (0 – 13) | |
| Hand dominance | Right | 107 | 2 (0 – 16) | 0.59 (0.552 |
| | Left | 11 | 1 (0 – 9) | |
| Marital status | Single | 33 | 2 (0 – 10) | 1.44 (0.486) |
| | Married | 78 | 3 (0 – 16) | |
| | Widowed / separated | 7 | 4 (0 – 16) | |
| Level of education | No school qualification / Hauptschulabschluß | 77 | 2 (0 – 16) | 6.45 (0.091) |
| | Realschulabschluß | 23 | 3 (0 – 16) | |
| | Fachhochschulreife | 7 | 1 (0 – 2) | |
| | Abitur | 11 | 2 (0 – 13) | |
| Highest work qualification | Abgeschlossene Lehre | 68 | 2 (0 – 16) | 12.31 (0.055) |
| | Handelsschule | 3 | 3 (1 – 13) | |
| | Fachschulabschluß | 18 | 2 (0 – 11) | |
| | Fachhochschulabschluß | 7 | 0 (0 – 4) | |
| | Universitätsabschluß | 9 | 2 (0 – 13) | |
| | Still in professional training | 3 | 0 (0 – 2) | |
| | No / other job qualification | 10 | 6 (0 – 15) | |
| Employment status after injury | Stayed the same | 61 | 2 (0 – 13) | 9.82 (0.007) |
| | Partly changed | 18 | 5 (0 – 16) | |
| | Changed completely | 9 | 6 (0 – 16) | |
| Level of income after injury | Drastically reduced | 6 | 11 (5 – 16) | 12.55 (0.002) |
| | Partly reduced | 11 | 4 (1 – 10) | |
| | Same | 71 | 2 (0 – 13) | |
| Treatment Groups | Replant | 45 | 1 (0 – 13) | 6.79 (0.079) |
| | Stump | 29 | 4 (0 – 15) | |
| | Mixed (R / S) | 24 | 3 (0 – 16) | |
| | Other | 20 | 3 (0 – 10) | |
| Time since injury | Less than 3 years | 24 | 3 (0 – 10) | 0.75 (0.455) |
| | 3 years or more | 94 | 2 (0 – 16) | |

Table 22: HADS - Depression - analysis I

Patients with the following sensory disturbances had significantly higher levels of depression: Cold ($p < 0.001$), pressure ($p < 0.001$), itching ($p = 0.039$), and weather dependency ($p = 0.030$). Patients, experiencing pain ($p < 0.001$), had significantly higher levels of depression. After Bonferroni adjustment, only cold, pressure discomfort and pain remained significant. While some differences between groups had been found with respect to anxiety and depression, it is important to note that a small percentage of people had borderline ($\geq 8$) or greater levels of anxiety and depression.

| | ***Yes*** | ***No*** | ***Mann – Whitney (z approximation) (p - value)*** |
|---|---|---|---|
| | ***Median (Min / Max)*** | ***Median (Min / Max)*** | |
| dull | 2 (0 – 16) | 2 (0 – 15) | 1.06 (0.286) |
| tingling | 2.5 (0 – 16) | 2 (0 – 16) | 1.18 (0.236) |
| cold | 4 (0 – 16) | 1 (0 – 13) | 3.51 (<0.001) |
| warm | 4 (0 – 16) | 2 (0 – 16) | 1.27 (0.204) |
| totally numb | 5 (0 – 16) | 2 (0 – 15) | 1.82 (0.069) |
| other | 3 (1 – 6) | 2 (0 – 16) | 0.53 (0.600) |
| pain | 5 (0 – 16) | 1 (0 – 8) | 4.56 (<0.001) |
| pressure | 5 (0 – 16) | 1 (0 – 9) | 4.64 (<0.001) |
| itching | 4 (0 – 13) | 2 (0 – 16) | 2.07 (0.039) |
| electrical sensation | 3 (0 – 15) | 2 (0 – 16) | 0.74 (0.458) |
| weather dependency | 3.5 (0 – 16) | 1.5 (0 – 12) | 2.17 (0.030) |

Table 23: HADS - Depression - Analysis II

*III.4.6.5 Body - Dysmorphic - Disorder - Examination - Self Report (BDDE - SR)*

The mean scores for this outcome measure was 26.3 (Std = 12.48; Median = 21.5; range = 18 - 85). This variable was also highly skewed to the left.

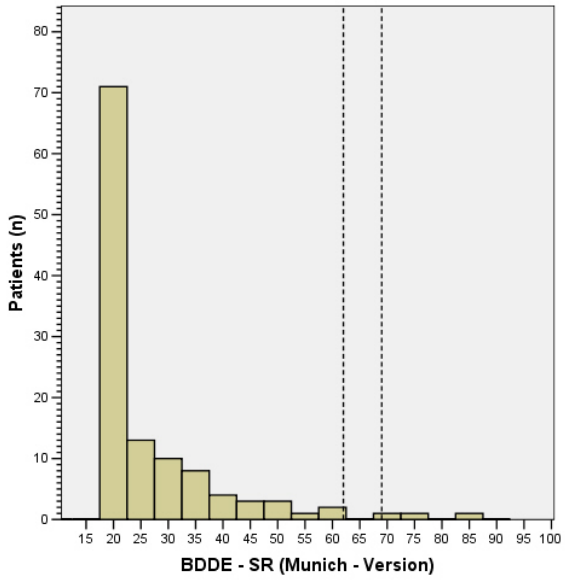


Figure 36: BDDE - SR, Munich - Version

The vertical dotted lines indicate the cut - off values.115 (97.5%) patients scored 0 - 62 (normal), 1 (0.8%) patient scored in the spectrum 63 - 68 (subclinical), and 2 (1.7%) patients scored 69 or above (clinically manifest).

A statistically significant difference had been found in the analysis of the following groups: Gender ($p < 0.001$), level of education ($p = 0.033$), employment status after injury ($p < 0.001$), level of income after injury ($p = 0.002$), and the four treatment groups ($p = 0.001$). After Bonferroni, gender, employment status and income level after injury as well as treatment groups remained significant.

**Gender:** Females have a significantly higher level of BDDE - SR than males.

**Employment status after injury:** Patients, whose employment status has changed completely, have the highest level of BDDE - SR.

**Level of income after injury:** Patients, whose income has reduced drastically, have the highest dysmorphia scores.

**Four treatment groups:** The Stump and Mixed Group had the highest BDDE - SR scores. The following groups were significantly different from each other: Mixed and Replant Group ($z = 3.18$; $p = 0.001$), Mixed and Other Group ($z = 2.24$; $p = 0.025$), Replant and Stump Group ($z = 3.30$; $p = 0.001$), and Stump and Other Group ($z = 2.13$; $p = 0.033$). After the Bonferroni adjustment, only the Mixed and Replant Groups as well as the Replant and Stump Groups remained significantly different.

| *Variable* | *Label* | *n* | *Median (Min / Max)* | *Mann – Whitney (z - approximation) / Kruskal -Wallis value (p - value)* |
|---|---|---|---|---|
| Gender | Male | 103 | 21 (18 – 85) | 3.53 (<0.001) |
| | Female | 15 | 33 (18 – 62) | |
| Hand dominance | Right | 107 | 21 (18 – 85) | 0.12 (0.906) |
| | Left | 11 | 22 (18 – 62) | |
| Marital status | Single | 33 | 22 (18 – 56) | 0.81 (0.668) |
| | Married | 78 | 21 (18 – 85) | |
| | Widowed / separated | 7 | 20 (18 – 62) | |
| Level of education | No school qualification / Hauptschulabschluß | 77 | 21 (18 – 85) | 8.73 (0.033) |
| | Realschulabschluß | 23 | 25 (18 – 59) | |
| | Fachhochschulreife | 7 | 22 (19 – 33) | |
| | Abitur | 11 | 18 (18 – 33) | |
| Highest work qualification | Abgeschlossene Lehre | 68 | 21 (18 – 85) | 9.32 (0.156) |
| | Handelsschule | 3 | 32 (22 – 38) | |
| | Fachschulabschluß | 18 | 20 (18 – 56) | |
| | Fachhochschulabschluß | 7 | 19 (18 – 29) | |
| | Universitätsabschluß | 9 | 18 (18 – 59) | |
| | Still in professional training | 3 | 31 (18 – 33) | |
| | No / other job qualification | 10 | 37.5 (18 – 73) | |
| Employment status after injury | Stayed the same | 61 | 19 (18 – 59) | 19.96 (<0.001) |
| | Partly changed | 18 | 30 (18 – 51) | |
| | Changed completely | 9 | 37 (18 – 85) | |
| Level of income after injury | Drastically reduced | 6 | 59.5 (37 – 85) | 17.19 (0.002) |
| | Partly reduced | 11 | 22 (18 – 39) | |
| | Same | 71 | 20 (18 – 59) | |
| Treatment Groups | Replant | 45 | 19 (18 -59) | 16.71 (0.001) |
| | Stump | 29 | 24 (18 – 73) | |
| | Mixed (R / S) | 24 | 23 (18 – 85) | |
| | Other | 20 | 19 (18 – 39) | |
| Time since injury | Less than 3 years | 24 | 23 (18 – 43) | 0.72 (0.471) |
| | 3 years or more | 94 | 21 (18 – 85) | |

Table 24: BDDE - SR (Munich - Version) - Analysis I

People, who experienced cold ($p = 0.026$), numbness ($p < 0.041$), pressure ($p < 0.001$), itching ($p = 0.012$), weather dependency ($p = 0.025$) and pain ($p < 0.001$) had significantly higher levels of BDDE - SR scores. However, only pain and pressure problems stayed significant after the correction. While some differences between groups had been found, the vast majority of patients (97.5%) scored within the 'normal' spectrum.

| | ***Yes*** | ***No*** | ***Mann - Whitney (z approximation) (p – value)*** |
|---|---|---|---|
| | ***Median (Min / Max)*** | ***Median (Min / Max)*** | |
| dull | 22 (18 – 68) | 19 (18 – 85) | 1.78 (0.077) |
| tingling | 25 (18 – 73) | 21 (18- 85) | 1.28 (0.202) |
| cold | 22 (18 – 85) | 20 (18 – 59) | 2.23 (0.026) |
| warm | 22 (18 – 85) | 21 (18 – 73) | 0.15 (0.885) |
| totally numb | 34 (18 – 85) | 21 (18 – 73) | 2.05 (0.041) |
| other | 21.5 (18 – 33) | 21.5 (18 – 85) | 0.15 (0.879) |
| pain | 27 (18 – 85) | 19 (18 – 56) | 4.15 (<0.001) |
| Pressure | 25 (18 – 85) | 19 (18 – 56) | 3.86 (<0.001) |
| itching | 30 (18 – 62) | 21 (18 – 85) | 2.51 (0.012) |
| electrical sensation | 22 (18 – 73) | 21 (18 – 85) | 0.45 (0.652) |
| weather dependency | 22 (18 – 85) | 20 (18 – 56) | 2.24 (0.025) |

Table 25: BDDE - SR (Munich - Version) - Analysis II

*III.4.6.6 FLZ - General Life Satisfaction*

The mean FLZ - General Satisfaction of Life was 69.1 (Std = 38.5; Median = 67.5; range = -23 - 160). Negative values indicate a predominance of dissatisfaction. This variable is normally distributed.

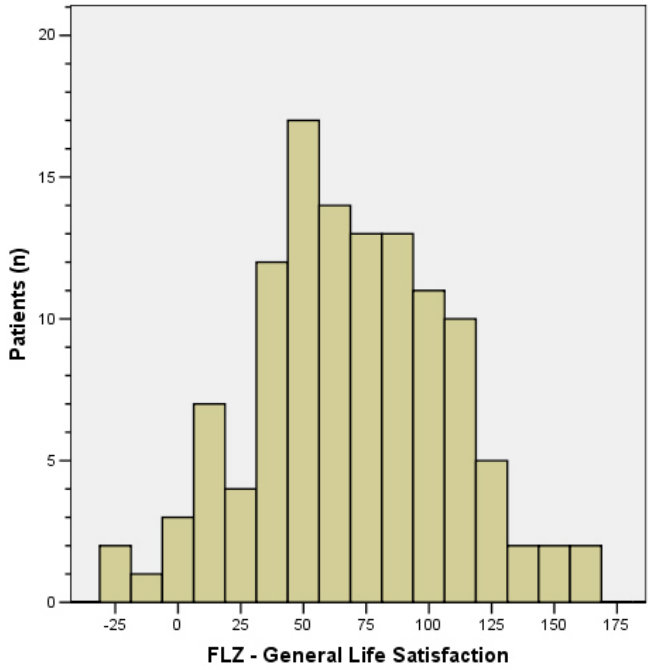


Figure 37: FLZ - General Life Satisfaction

The FLZ - General Life Satisfaction scores have been related again to the nine items in the left column. As the FLZ - General Life Satisfaction is normally distributed, it will be analysed using parametric tests, either unpaired t - tests or one - way analysis of variance (ANOVA). Unpaired t - testing was used, when two groups were compared. One - way analysis of variance (ANOVA) was used when more than two groups were compared.

A statistically significant difference had been found for hand dominance ($p = 0.044$), employment status ($p = 0.010$) and level of income after injury ($p < 0.001$). After Bonferroni correction, income level after injury remained significant. Applying post - hoc pair wise comparisons to this analysis, General Life Satisfaction was significantly higher in the patients, whose income had stayed the same compared with the other two groups: Partly reduced income ($p = 0.031$) and drastically reduced income ($p = 0.001$). There was, however, no statistically significant difference between the slightly reduced and the drastically reduced income groups.

| *Variable* | *Label* | *n* | *Mean (SD)* | *Unpaired t - test (t) / one-way ANOVA (F) (p - value)* |
|---|---|---|---|---|
| Gender | Male | 103 | 69.3 (39.4) | 0.12 (0.903) |
| | Female | 15 | 68.0 (32.5) | |
| Hand dominance | Right | 107 | 66.9 (38.2) | 2.04 (0.044) |
| | Left | 11 | 91.4 (35.1) | |
| Marital status | Single | 33 | 60.1 (40.3) | 1.42 (0.245) |
| | Married | 78 | 73.3 (35.5) | |
| | Widowed / separated | 7 | 64.9 (57.6) | |
| Level of education | No school qualification / Hauptschulabschluß | 77 | 69.1 (37.6) | 0.94 (0.422) |
| | Realschulabschluß | 23 | 60.4 (43.6) | |
| | Fachhochschulreife | 7 | 83.4 (28.4) | |
| | Abitur | 11 | 78.7 (39.2) | |
| Highest work qualification | Abgeschlossene Lehre | 68 | 70.1 (37.1) | 1.87 (0.093) |
| | Handelssschule | 3 | 103.0 (55.8) | |
| | Fachschulabschluß | 18 | 60.6 (33.9) | |
| | Fachhochschulabschluß | 7 | 88.9 (27.4) | |
| | Universitätsabschluß | 9 | 68.8 (45.5) | |
| | Still in professional training | 3 | 99.3 (64.3) | |
| | No / other job qualification | 10 | 45.4 (34.1) | |
| Employment status after injury | Stayed the same | 61 | 74.2 (33.7) | 4.86 (0.010) |
| | Partly changed | 18 | 47.6 (29.1) | |
| | Changed completely | 9 | 55.1 (43.9) | |
| Level of income after injury | Drastically reduced | 6 | 22.5 (37.7) | 9.45 (<0.001) |
| | Partly reduced | 11 | 48.2 (27.8) | |
| | Same | 71 | 73.7 (32.6) | |
| Treatment Groups | Replant | 45 | 75.9 (36.9) | 1.31 (0.274) |
| | Stump | 29 | 65.8 (34.2) | |
| | Mixed (R / S) | 24 | 57.6 (46.3) | |
| | Other | 20 | 72.6 (36.8) | |
| Time since injury | Less than 3 years | 24 | 65.0 (29.5) | 0.58 (0.561) |
| | 3 years or more | 94 | 70.2 (40.5) | |

Table 26: FLZ - General Life Satisfaction - Analysis I

| | ***Yes*** | ***No*** | ***Unpaired t - test (t) (p - value)*** |
|---|---|---|---|
| | ***Mean (SD)*** | ***Mean (SD)*** | |
| dull | 65.2 (37.0) | 72.9 (39.8) | 1.08 (0.281) |
| tingling | 66.0 (37.4) | 70.7 (39.2) | 0.63 (0.531) |
| cold | 60.0 (38.8) | 75.9 (37.1) | 2.25 (0.027) |
| warm | 35.9 (31.2) | 71.9 (37.9) | 2.77 (0.006) |
| totally numb | 36.7 (50.8) | 71.2 (37.0) | 2.34 (0.021) |
| other | 69.5 (29.1) | 69.1 (39.2) | 0.03 (0.979) |
| pain | 55.1 (37.4) | 82.3 (35.0) | 4.09 (<0.001) |
| pressure | 53.8 (35.6) | 79.3 (37.1) | 3.72 (<0.001) |
| itching | 46.6 (29.3) | 72.9 (38.7) | 2.58 (0.008) |
| electrical sensation | 69.4 (32.7) | 69.1 (40.3) | 0.05 (0.965) |
| weather dependency | 65.8 (40.8) | 72.6 (36.0) | 0.95 (0.342) |

Table 27: FLZ - General Life Satisfaction - Analysis II for study group

People with cold ($p = 0.027$), warm ($p = 0.006$), totally numb ($p = 0.021$), pressure ($p < 0.001$) and itching ($p = 0.008$) discomfort were less satisfied in life. Patients, who experienced pain ($p < 0.001$), had a significantly lower levels as well. After Bonferroni, only pain and pressure sensory disturbances remained significant.

*III.4.6.7 FLZ - Health*

For the total of 118 patients, the mean FLZ - Health scores were 66.8 (Std = 44.9; Median = 71.5; range = -96 - 160). This variable is also normally distributed.

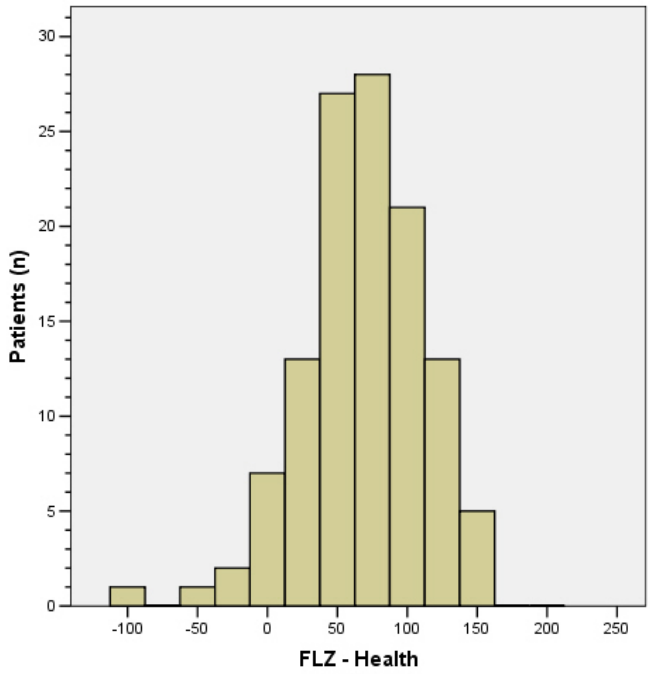


Figure 38: FLZ - Health

As the FLZ - Health measure is normally distributed, it will be analysed using either unpaired t - tests or one - way analysis of variance (ANOVA), as appropriate.
A statistically significant difference had been found in the analysis of employment status ($p = 0.021$) and level of income after injury ($p < 0.001$).
After Bonferroni correction, income level after injury was still significant. Comparing each income group, the FLZ - Health score was significantly lower in patients, whose income level had drastically reduced compared with the other two groups: Partly reduced income ($p = 0.010$) and same income ($p < 0.001$). There was, however, no statistically significant difference between the slightly reduced and the same income groups.

| *Variable* | *Label* | *n* | *Mean (SD)* | *Unpaired t - test (t) / one -way ANOVA (F) (p - value)* |
|---|---|---|---|---|
| Gender | Male | 103 | 70.5 (45.4) | 1.07 (0.289) |
| | Female | 15 | 57.3 (40.0) | |
| Hand dominance | Right | 107 | 67.4 (44.6) | 1.02 (0.310) |
| | Left | 11 | 81.9 (46.8) | |
| Marital status | Single | 33 | 81.8 (37.5) | 2.06 (0.132) |
| | Married | 78 | 64.4 (45.1) | |
| | Widowed / separated | 7 | 56.1 (65.4) | |
| Level of education | No school qualification / Hauptschulabschluß | 77 | 66.9 (46.0) | 1.26 (0.293) |
| | Realschulabschluß | 23 | 63.8 (47.8) | |
| | Fachhochschulreife | 7 | 99.3 (27.6) | |
| | Abitur | 11 | 72.8 (33.8) | |
| Highest work qualification | Abgeschlossene Lehre | 68 | 70.6 (46.8) | 1.25 (0.286) |
| | Commercial school | 3 | 56.3 (54.1) | |
| | Fachschulabschluß | 18 | 68.1 (31.8) | |
| | Fachhochschulabschluß | 7 | 88.9 (27.8) | |
| | Universitätsabschluß | 9 | 62.9 (50.1) | |
| | Still in professional training | 3 | 104.3 (55.5) | |
| | No / other job qualification | 10 | 41.8 (46.6) | |
| Employment status after injury | Stayed the same | 61 | 75.1 (38.0) | 4.02 (0.021) |
| | Partly changed | 18 | 47.2 (40.3) | |
| | Changed completely | 9 | 46.7 (71.8) | |
| Level of income after injury | Drastically reduced | 6 | -2.3 (63.6) | 9.97 (< 0.001) |
| | Partly reduced | 11 | 59.5 (39.4) | |
| | Same | 71 | 73.4 (38.2) | |
| Treatment Groups | Replant | 45 | 72.0 (39.4) | 0.51 (0.678) |
| | Stump | 29 | 66.9 (50.6) | |
| | Mixed (R / S) | 24 | 60.1 (53.4) | |
| | Other | 20 | 74.8 (37.3) | |
| Time since injury | Less than 3 years | 24 | 69.0 (34.8) | 0.03 (0.979) |
| | 3 years or more | 94 | 68.7 (47.2) | |

Table 28: FLZ - Health - Analysis I

Patients, who have the following sensory disturbances, had significantly lower levels of health scores: Cold (p = 0.001), warm (p = 0.022), totally numb (p = 0.004), pressure (p = 0.002) and itching (p = 0.001). Patients, with pain (p < 0.001) had significantly lower levels, too. After Bonferroni, only patients with cold, totally numb, pressure, and itching disturbances and pain showed significantly lower levels.

| | ***Yes*** | ***No*** | ***Unpaired t - test (t) (p - value)*** |
|---|---|---|---|
| | ***Mean (SD)*** | ***Mean (SD)*** | |
| dull | 71.3 (42.8) | 66.4 (46.9) | 0.58 (0.560) |
| tingling | 59.2 (42.8) | 73.7 (45.3) | 1.68 (0.095) |
| cold | 53.6 (46.8) | 80.0 (40.2) | 3.29 (0.001) |
| warm | 36.1 (58.2) | 71.5 (43.0) | 2.32 (0.022) |
| totally numb | 21.9 (71.5) | 71.7 (41.4) | 2.95 (0.004) |
| other | 69.4 (43.0) | 68.7 (45.2) | 0.04 (0.969) |
| pain | 52.7 (45.8) | 83.8 (38.6) | 3.99 (<0.001) |
| pressure | 53.2 (47.2) | 79.1 (40.3) | 3.19 (0.002) |
| Itching | 36.9 (33.0) | 74.1 (44.5) | 3.29 (0.001) |
| electrical sensation | 63.0 (37.2) | 70.6 (47.0) | 0.78 (0.437) |
| weather dependency | 63.4 (49.7) | 74.3 (38.9) | 1.33 (0.188) |

Table 29: FLZ - Health - Analysis II

*III.4.6.8 FLZ - Outer Appearance*

The mean FLZ - Outer Appearance - scores were 29.4 (Std = 78.6; Median = 23.5; range = -173 - 264). This variable is normally distributed.

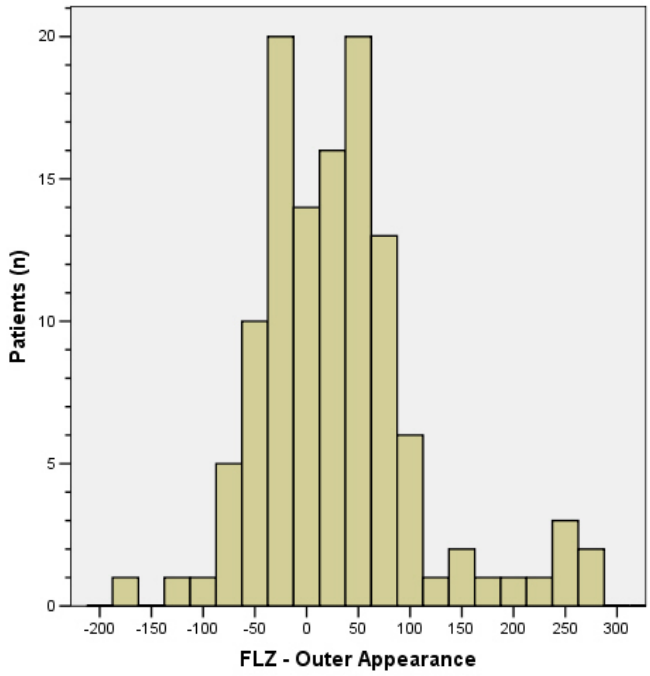


Figure 39: FLZ - Outer Appearance

Patients with different highest work qualifications had significantly different levels of outer appearance scores (p = 0.002). After Bonferroni adjustment (p = 0.006), the variable of highest work qualification was still significant.
Patients with a `Fachschul` - qualification have the lowest scores for outer appearance and those with a degree from a `Handelsschule` have the highest scores for Outer Appearance. Post - hoc comparisons showed that those patients, who had completed an apprenticeship (`Lehre`), had significantly lower scores than the people with a `Handelsschule` - qualification (p = 0.018). Patients, who had attended a `Handelsschule`, had significantly higher scores than the `Fachschul` - group (p = 0.010), and the no / other job qualification group (p = 0.049). The `Fachschul` - group had significantly lower scores than those patients, who were still in professional training (p = 0.029).

| *Variable* | *Label* | *n* | *Mean (SD)* | *Unpaired t - test (t) / one -way ANOVA (F) (p - value)* |
|---|---|---|---|---|
| Gender | Male | 103 | 28.1 (74.7) | 0.50 (0.616) |
| | Female | 15 | 39.0 (104.2) | |
| Hand dominance | Right | 107 | 28.4 (78.8) | 0.47 (0.639) |
| | Left | 11 | 40.1 (79.6) | |
| Marital status | Single | 33 | 34.1 (70.5) | 2.18 (0.117) |
| | Married | 78 | 22.5 (78.3) | |
| | Widowed / separated | 7 | 85.4 (104.2) | |
| Level of education | No school qualification / Hauptschulabschluß | 77 | 27.5 (74.7) | 0.11 (0.954) |
| | Realschulabschluß | 23 | 28.3 (108.1) | |
| | Fachhochschulreife | 7 | 37.1 (63.0) | |
| | Abitur | 11 | 40.5 (39.3) | |
| Highest work qualification | Abgeschlossene Lehre | 68 | 23.4 (69.3) | 3.71 (0.002) |
| | Handelsschule | 3 | 172 (131.6) | |
| | Fachschulabschluß | 18 | 7.4 (53.8) | |
| | Fachhochschulabschluß | 7 | 29.9 (70.0) | |
| | Universitätsabschluß | 9 | 37.9 (56.8) | |
| | Still in professional training | 3 | 157.7 (144.6) | |
| | No / other job qualification | 10 | 21.2 (104.0) | |
| Employment status after injury | Stayed the same | 61 | 28.3 (68.5) | 2.68 (0.074) |
| | Partly changed | 18 | -5.7 (50.4) | |
| | Changed completely | 9 | 55.0 (100.6) | |
| Level of income after injury | Drastically reduced | 6 | 55.0 (108.1) | 1.98 (0.144) |
| | Partly reduced | 11 | -10.3 (36.3) | |
| | Same | 71 | 26.8 (69.8) | |
| Treatment Groups | Replant | 45 | 26.9 (75.9) | 0.95 (0.420) |
| | Stump | 29 | 37.2 (83.1) | |
| | Mixed (R / S) | 24 | 9.9 (72.6) | |
| | Other | 20 | 47.3 (85.0) | |
| Time since injury | Less than 3 years | 24 | 12.8 (79.4) | 1.16 (0.248) |
| | 3 years or more | 94 | 33.7 (78.2) | |

Table 30: FLZ - Outer Appearance - Analysis I

| | ***Yes*** | ***No*** | ***Unpaired t - test (t) (p - value)*** |
|---|---|---|---|
| | ***Mean (SD)*** | ***Mean (SD)*** | |
| dull | 26.0 (72.9) | 32.6 (84.0) | 0.46 (0.650) |
| tingling | 11.2 (81.5) | 38.8 (75.9) | 1.83 (0.070) |
| cold | 26.7 (75.5) | 31.5 (81.3) | 0.325 (0.746) |
| warm | 16.1 (44.5) | 30.6 (80.8) | 0.53 (0.598) |
| totally numb | 24.9 (65.0) | 29.7 (79.6) | 0.16 (0.874) |
| other | 21.1 (41.8) | 30.1 (80.7) | 0.31 (0.758) |
| pain | 19.9 (82.4) | 38.4 (74.4) | 1.29 (0.201) |
| pressure | 20.8 (74.6) | 35.2 (81.2) | 0.97 (0.335) |
| Itching | -4.1 (85.7) | 35.1 (76.3) | 1.92 (0.057) |
| electrical sensation | 27.5 (90.9) | 30.1 (74.9) | 0.15 (0.879) |
| weather dependency | 36.0 (90.3) | 22.7 (64.3) | 0.92 (0.361) |

Table 31: FLZ - Outer Appearance - Analysis II

None of the sensory disturbances indicated significantly higher or lower levels of the FLZ - Outer Appearance measure. Patients with and without pain were not significantly different with regards to their outer appearance scores.

*III.4.6.9 FBeK - Attractiveness / Self – Confidence*

The mean FBeK - Attractiveness / Self - Confidence score was 11.9 (Std = 3.2; Median = 13; range = 0 -15). This variable is highly skewed to the right, indicating the majority of patients had FBeK scores at the higher end of the spectrum.

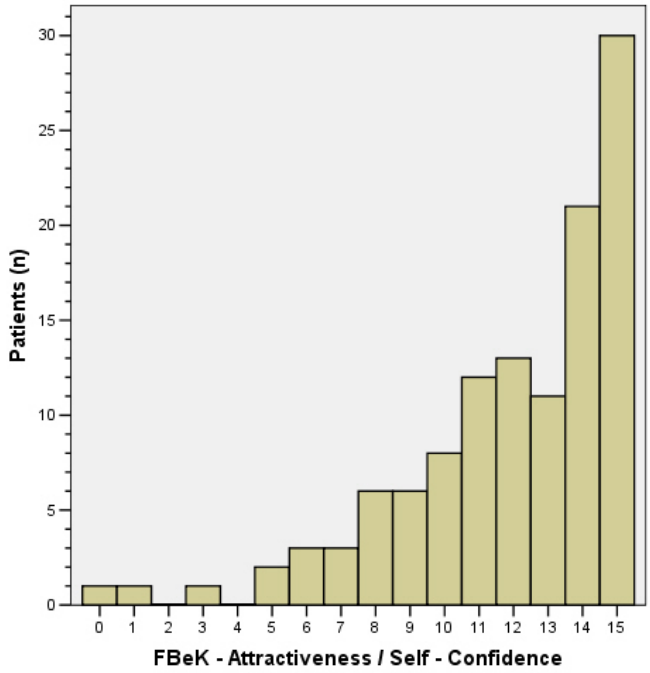


Figure 40: FBeK - Attractiveness / Self - Confidence

This FBeK scale was analysed using the non-parametric tests Mann - Whitney - U - Test or Kruskal - Wallis - Test, as appropriate. As the variable was skewed the median, minimum and maximum values were given.

The distribution of the FBeK scores differed significantly across the various groups of work qualifications ($p = 0.027$) and across the different groups of income levels after injury ($p = 0.001$). After Bonferroni correction, only the different groups of income displayed significantly different FBeK scores. Patients, who had their income drastically reduced after injury, had lower scores.

| *Variable* | *Label* | *n* | *Median (Min / Max)* | *Mann - Whitney (z - approximation) / Kruskal -Wallis value (p - value)* |
|---|---|---|---|---|
| Gender | Male | 103 | 13 (1 - 15) | 1.26 (0.207) |
| | Female | 15 | 12 (0 - 15) | |
| Hand dominance | Right | 107 | 13 (0 – 15) | 1.46 (0.145) |
| | Left | 11 | 14 (7 - 15) | |
| Marital status | Single | 33 | 12 (3 – 15) | 1.45 (0.484) |
| | Married | 78 | 13 (0 – 15) | |
| | Widowed / separated | 7 | 12 (7 - 15) | |
| Level of education | No school qualification / Hauptschulabschluß | 77 | 13 (5 – 15) | 3.08 (0.380) |
| | Realschulabschluß | 23 | 12 (0 – 15) | |
| | Fachhochschulreife | 7 | 14 (9 – 15) | |
| | Abitur | 11 | 14 (6 – 15) | |
| Highest work qualification | Abgeschlossene Lehre | 68 | 13 (3 – 15) | 14.28 (0.027) |
| | Handelsschule | 3 | 15 (12 – 15) | |
| | Fachschulabschluß | 18 | 12.5 (8 – 15) | |
| | Fachhochschulabschluß | 7 | 13 (6– 15) | |
| | Universitätsabschluß | 9 | 14 (1 – 15) | |
| | Still in professional training | 3 | 14 (14 – 15) | |
| | No / other job qualification | 10 | 9 (0 - 15) | |
| Employment status after injury | Stayed the same | 61 | 13 (0– 15) | 5.39 (0.068) |
| | Partly changed | 18 | 11 (3 – 15) | |
| | Changed completely | 9 | 12 (6– 15) | |
| Level of income after injury | Drastically reduced | 6 | 9 (6 - 11) | 13.08 (0.001) |
| | Partly reduced | 11 | 10 (3 - 15) | |
| | Same | 71 | 14 (0 – 15) | |
| Treatment Groups | Replant | 45 | 14 (1 - 15) | 1.31 (0.728) |
| | Stump | 29 | 13 (0– 15) | |
| | Mixed (R / S) | 24 | 12 (5 – 15) | |
| | Other | 20 | 12.5 (3 - 15) | |
| Time since injury | Less than 3 years | 24 | 13 (0– 15) | 0.55(0.581) |
| | 3 years or more | 94 | 13 (1 – 15) | |

Table 32: FBeK - Attractiveness / Self - Confidence - Analysis I

| | ***Yes*** | ***No*** | ***Mann - Whitney (z approximation) (p - value)*** |
|---|---|---|---|
| | ***Median (Min/Max)*** | ***Median (Min/Max)*** | |
| dull | 13 (1 - 15) | 13 (0 - 15) | 0.37 (0.717) |
| tingling | 12 (0 - 15) | 13 (3 - 15) | 0.76 (0.449) |
| cold | 12 (3 - 15) | 13 (0 - 15) | 1.36 (0.175) |
| warm | 11 (8 – 15) | 13 (0 - 15) | 1.33 (0.185) |
| totally numb | 10 (3 - 15) | 13 (0 - 15) | 1.65 (0.100) |
| other | 12 (5 – 14) | 13 (0 - 15) | 0.96 (0.337) |
| pain | 12 (0 - 15) | 13 (6 - 15) | 2.04 (0.042) |
| pressure | 11 (0 - 15) | 13 (5 - 15) | 2.15 (0.032) |
| itching | 10 (0 - 15) | 13 (3 - 15) | 2.66 (0.008) |
| electrical sensation | 13.5 (5 - 15) | 13 (0 - 15) | 0.56 (0.575) |
| weather dependency | 12 (0 - 15) | 13 (3 - 15) | 0.97 (0.332) |

Table 33: FBeK - Attractiveness / Self - Confidence - Analysis II

Patients, who had the following sensory problems, had significantly lower scores of this FBeK module: Pressure and itching. Also patients, who had pain, scored significantly higher. After correction, none of the above showed significant differences.

### *III.4.6.10 FBeK - Accentuation of Physical Appearance*

The mean FBeK - Accentuation of Physical Appearance score is 6.4 (Std = 2.4; Median = 7; range = 1 - 11). This variable is normally distributed.

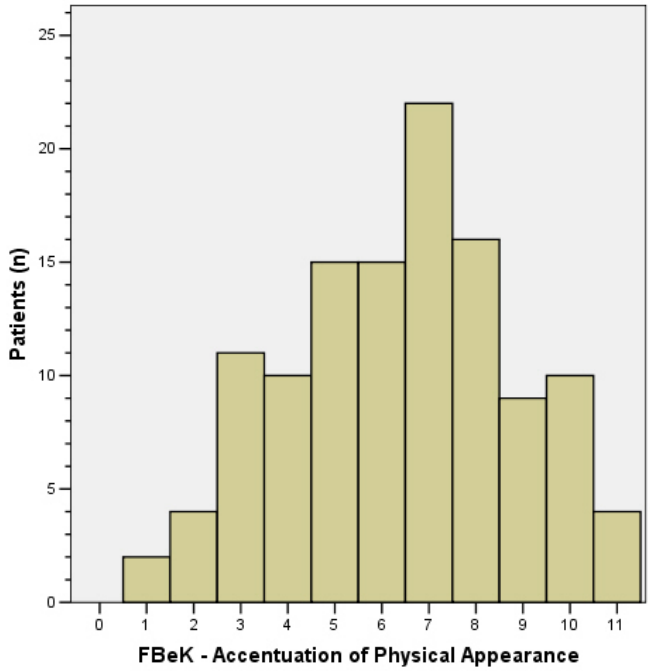


Figure 41: FBeK - Accentuation of Physical Appearance

Analyses was performed by using parametric tests, either unpaired t - tests or one - way analysis of variance (ANOVA).

Analysis revealed that the gender variable had significantly different levels of this FBeK ($p = 0.004$). Females had significantly higher levels of FBeK - Accentuation of Physical Appearance scores. This was still significant after Bonferroni correction.

| *Variable* | *Label* | *n* | *Mean (SD)* | *Unpaired t - test (t) / one -way ANOVA (F) (p - value)* |
|---|---|---|---|---|
| Gender | Male | 103 | 6.2 (2.4) | 3.16 (0.004) |
| | Female | 15 | 7.7 (1.6) | |
| Hand dominance | Right | 107 | 6.4 (2.4) | 0.31 (0.761) |
| | Left | 11 | 6.6 (2.7) | |
| Marital status | Single | 33 | 7.0 (2.5) | 1.94 (0.148) |
| | Married | 78 | 6.1 (2.4) | |
| | Widowed / separated | 7 | 7.1 (0.7) | |
| Level of education | No school qualification / Hauptschulabschluß | 77 | 6.4 (2.4) | 0.51 (0.677) |
| | Realschulabschluß | 23 | 6.9 (2.4) | |
| | Fachhochschulreife | 7 | 6.0 (2.3) | |
| | Abitur | 11 | 5.9 (2.7) | |
| Highest work qualification | Abgeschlossene Lehre | 68 | 6.6 (2.4) | 1.25 (0.287) |
| | Handelsschule | 3 | 8.0 (2.0) | |
| | Fachschulabschluß | 18 | 6.6 (2.5) | |
| | Fachhochschulabschluß | 7 | 5.0 (2.4) | |
| | Universitätsabschluß | 9 | 6.3 (2.6) | |
| | Still in professional training | 3 | 7.7 (2.5) | |
| | No / other job qualification | 10 | 5.2 (2.1) | |
| Employment status after injury | Stayed the same | 61 | 6.2 (2.3) | 0.65 (0.523) |
| | Partly changed | 18 | 6.8 (2.6) | |
| | Changed completely | 9 | 5.8 (2.6) | |
| Level of income after injury | Drastically reduced | 6 | 5.8 (2.1) | 0.13 (0.875) |
| | Partly reduced | 11 | 6.5 (3.1) | |
| | Same | 71 | 5.8 (2.1) | |
| Treatment Groups | Replant | 45 | 6.0 (2.2) | 0.77 (0.551) |
| | Stump | 29 | 6.6 (2.5) | |
| | Mixed (R / S) | 24 | 6.6 (2.6) | |
| | Other | 20 | 6.8 (2.6) | |
| Time since injury | Less than 3 years | 24 | 7.1 (2.5) | 1.57 (0.118) |
| | 3 years or more | 94 | 6.2 (2.4) | |

Table 34: FBeK - Accentuation of Physical Appearance - Analysis I

| | ***Yes*** | ***No*** | ***Unpaired t - test (t) (p - value)*** |
|---|---|---|---|
| | ***Mean (SD)*** | ***Mean (SD)*** | |
| dull | 6.6 (2.3) | 6.2 (2.5) | 0.79 (0.432) |
| tingling | 6.7 (2.4) | 6.3 (2.4) | 0.81 (0.418) |
| cold | 6.5 (2.4) | 6.3 (2.4) | 0.39 (0.695) |
| warm | 4.6 (1.9) | 6.6 (2.4) | 2.44 (0.016) |
| totally numb | 5.7 (3.3) | 6.4 (2.4) | 0.78 (0.440) |
| other | 6.5 (2.2) | 6.4 (2.4) | 0.12 (0.902) |
| pain | 6.8 (2.5) | 6.0 (2.3) | 1.64 (0.203) |
| pressure | 6.2 (2.6) | 6.5 (2.3) | 0.60 (0.548) |
| itching | 6.1 (2.7) | 6.5 (2.4) | 0.63 (0.531) |
| electrical sensation | 7.6 (2.1) | 6.0 (2.4) | 3.26 (0.001) |
| weather dependency | 6.3 (2.4) | 6.5 (2.4) | 0.37 (0.709) |

Table 35: FBeK - Accentuation of Physical Appearance - Analysis II

Only patients, who experienced electrical sensation, when touching the scar, had higher levels of this FBeK ($p = 0.001$). This was still significant after the correction.

### *III.4.6.11 Relationship of HISS - Categories to Outcome Questionnaires*

| | HISS categories | | | | | | ANOVA (F) /Kruskal - Wallis – Chi Square (p - value) |
|---|---|---|---|---|---|---|---|
| | 51 - 100 (n = 21) | 101 - 150 (n = 25) | 151 - 200 (n = 25) | 201 - 250 (n = 16) | 251 - 300 (n = 8) | > 300 (n = 23) | |
| DASH | 5.8 (0-32.5) | 16.7 (0-65.8) | 11.7 (0-94.2) | 12.5 (0-45.8) | 29.6 (3.3-79.2) | 28.3 (0-100) | 14.21 (0.014) |
| DASH-Sport / Art[#] | 12.5 (0-75) | 21.9 (0-81.3) | 3.1 (0-100) | 15.6 (0-100) | 43.8 (0-75) | 40.6 (0-100) | 4.75 (0.448) |
| HADS - Anxiety | 3 (0-10) | 3 (0-14) | 4 (0-15) | 4 (0-17) | 1 (0-14) | 4 (0-21) | 4.28 (0.510) |
| HADS - Depression | 2 (0-7) | 3 (0-13) | 2 (0-16) | 1 (0-13) | 1 (0-3) | 5 (0-16) | 12.24 (0.032) |
| BDDE - SR | 19 (18-56) | 22 (18-59) | 19 (18-73) | 20.5 (18-38) | 21.5 (18-30) | 30 (18-85) | 17.81 (0.003) |
| FLZ - GS | 69.3 (35.8) | 67.5 (35.6) | 65.0 (37.3) | 87.4 (47.1) | 77.9 (35.5) | 59.4 (38.8) | 1.17 (0.328) |
| FLZ - H | 77.9 (35.4) | 60.7 (44.2) | 57.4 (46.6) | 84.4 (42.1) | 87.3 (33.3) | 64.3 (53.6) | 1.39 (0.235) |
| FLZ - O | 29.7 (68.1) | 29.9 (75.3) | 28.5 (88.8) | 40.6 (101.1) | 5.8 (68.7) | 30.2 (71.3) | 0.20 (0.960) |
| FBeK - Attractive-ness / Self. | 13 (6-15) | 12 (1-15) | 14 (0-15) | 13 (5-15) | 14 (10-14) | 12 (7-15) | 2.15 (0.828) |
| FBeK - Phys. App. | 6.0 (2.3) | 6.7 (2.8) | 6.2 (2.3) | 7.0 (2.1) | 6.1 (2.0) | 6.3 (2.7) | 0.41 (0.844) |

Table 36: Relationship of HISS - categories to outcome questionnaires

The following outcome questionnaires were not normally distributed and had been therefore summarized by the median (Min / Max) and related to the HISS - categories, using Kruskal - Wallis - Tests:
DASH, DASH - Sport / Performing Arts, HADS - Anxiety, HADS - Depression, BDDE - SR, and FBeK - Attractiveness / Self - Confidence.
The remaining outcome measures were normally distributed. They were summarised by the mean (Std) and related to the HISS - categories, using one - way analysis of variance:
FLZ - General Life Satisfaction, FLZ - Health, FLZ - Outer Appearance, and FBeK - Accentuation of Physical Appearance.

[#] For DASH - Sport/Performing Arts the numbers are slightly different:
18 for 51-100, 22 for 101-150, 18 for 151-200, 14 for 201-250, 4 for 251-300, and 20 for > 300.

It had been shown that the distribution of the following outcome measures differs significantly between the HISS - categories at a significance level of $< 0.05$:
DASH ($p = 0.014$), HADS - Depression ($p = 0.032$), and BDDE - SR ($p = 0.003$).

**DASH:** The lowest HISS group has the lowest median DASH scores. The two most severe HISS - categories have the highest median DASH scores.
**HADS -Depression:** The most severe HISS - category has the highest median HADS - Depression scores.
**BDDE - SR:** The most severe HISS - category has the highest median BDDE - SR scores.

Out of all the outcome questionnaires, the DASH and BDDE - SR measures had also been shown to have the highest correlation with the HISS, when not subdivided (DASH: $r = 0.26$; BDDE - SR: $r = 0.24$). These correlation coefficients (r) were significant, when using an unadjusted level of significance ($r \geq 0.18$; $p < 0.05$). However, after Bonferroni adjustment for multiple testing (see correlation matrix, Table 38), these correlation coefficients were not considered to be significantly different from 0, as they fell below the adjusted level of significance for correlation coefficients ($r \geq 0.27$; $p < 0.003$). This was also evidenced graphically in the three scatter plot graphs (Figure 42 - 44).
In all three graphs, multiple points were randomly scattered, indicating that the relationship between HISS (not categorized) and the outcome measures was not strong. It must be emphasized that the analysis of the relationship between DASH / BDDE - SR / HADS - Depression and the subcategorized HISS had revealed that there was a tendency towards significance in the highest HISS - categories. However, as there were not many patients (19.5 %) with extreme hand injury severity (HISS > 300), this significance becomes diluted, when the HISS - subcategories were combined into one group.
There appeared to be some evidence that those people with the most severe hand injuries had a worse functional disability and a higher level of body dysmorphia.

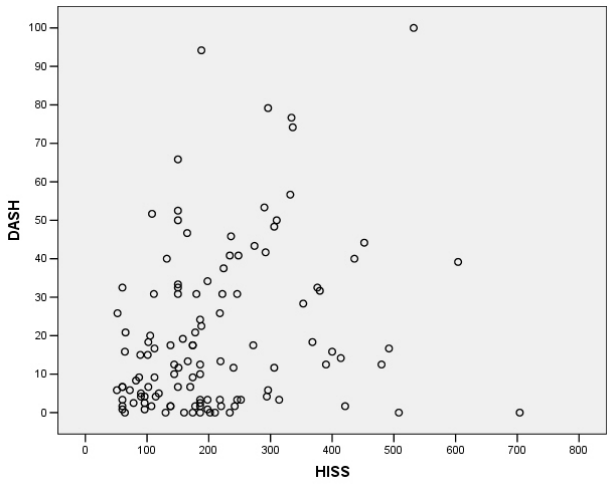


Figure 42: Scatter plot HISS related to DASH

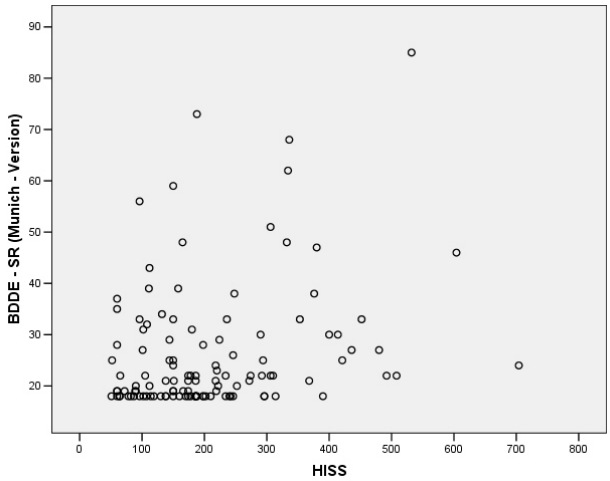


Figure 43: Scatter plot HISS related to BDDE - SR

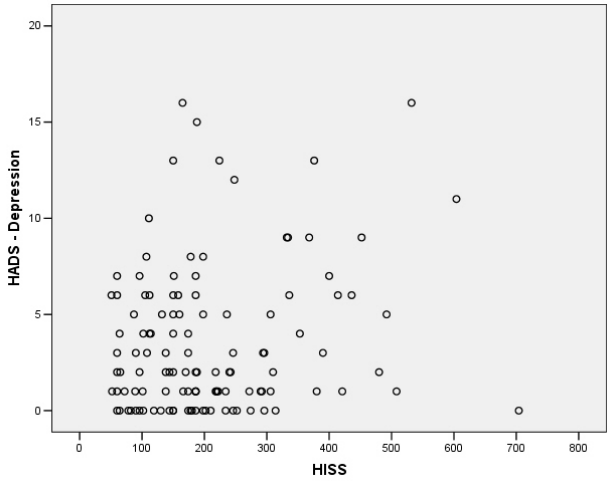


Figure 44: Scatter plot HISS related to HADS – Depression

III.4.7 Correlation Matrix

Spearmans Rank Correlation Coefficients (r) have been calculated between all outcome measures and questions that were asked on a Likert - Scale or on a scale from 0 to 10. Spearmans Rank Correlation Coefficients have been used as many of the variables are skewed. The numbers in the correlation matrix are the correlation coefficients. The matrix is symmetric about the diagonal indicated by 1's.

Any correlation, $\geq 0.18$ is significant at the level of 0.05 ($p < 0.05$). However, as each variable is being correlated against 18 others, a more appropriate significance level (using a Bonferroni correction) is 0.05/18 = 0.003 (to 3 decimal places).
Therefore, only correlation coefficients $\geq 0.27$ should be treated as significantly different from 0. In interpreting the direction of the correlation coefficients, one has to remember in what direction the variables are scored in. For example, increasing levels of HADS indicates more anxiety or depression, but higher levels of FLZ scores indicate higher levels of general life satisfaction, health or outer appearance.
Furthermore, it must be emphasized that despite correlation coefficients being significantly different from 0 after adjustment for multiple testing ($r \geq 0.27$; $p < 0.003$), one still needs to decide, whether this difference is clinically important.
This is especially relevant for correlations based on a large sample.
Therefore, the author used Cohen`s classification on correlation coefficients (Cohen, 1988, p 79; Cohen, 1992, p 157):

| Correlation | Negative | Positive |
|---|---|---|
| Small | - 0.29 to - 0.10 | 0.10 to 0.29 |
| Medium | - 0.49 to - 0.30 | 0.30 to 0.49 |
| Large | - 0.50 to - 1.00 | 0.50 to 1.00 |

As this study is dealing with quality of life outcome after severe hand injuries, the correlations with the HISS will be highlighted. The associations between DASH / BDDE - SR / HADS - Depression and HISS have already been discussed in chapter III.4.6.11. Correlations, which are significantly different from 0 at the adjusted level of significance ($r \geq 0.27$; $p < 0.003$), include finger mobility ($r = 0.28$) and strength in hand and finger ($r = 0.28$). The higher the HISS, the worse is the finger mobility and the worse is the strength in hand and finger. Although significantly different from 0, it can be seen that the strength of correlation between these variables and HISS is `small`, according to Cohen`s classification.

The following coefficients are statistically significantly different from 0 at the unadjusted level ($r \geq 0.18$; $p < 0.05$):
DASH ($r = 0.26$), BDDE - SR ($r = 0.24$), ability to perform manual labour ($r = 0.24$), and work satisfaction ($r = - 0.20$). The higher the HISS, the poorer is the ability to perform manual labour. Patients with high HISS scores are also not very satisfied with their work situation. According to Cohen, these correlations are again `small`.

Negligible statistically significant difference from 0, at an unadjusted level of significance ($r \geq 0.18$; $p < 0.05$), has been found for the following correlations with HISS:
FLZ - General Life Satisfaction ($r = 0.01$), FLZ - Outer Appearance ($r = - 0.02$), FLZ - Health ($r = 0.03$), FBeK - Accentuation of Physical Appearance ($r = 0.03$), FBeK - Attractiveness / Self - Confidence ($r = 0.04$), satisfaction with the surgical result ($r = 0.06$), sensation ($r = 0.09$), HADS - Anxiety ($r = 0.10$), HADS - Depression ($r = 0.11$), frequency of pain ($r = 0.13$), DASH - Sport / Performing Arts ($r = 0.13$), and cold intolerance ($r = 0.16$). In other words, the severity of hand injury level does not impact on the assessment of general life satisfaction, health and outer appearance, according to the FLZ questionnaires. Neither has HISS a big influence on attractiveness, self - confidence and physical appearance, according to the FBeK outcome measures. Satisfaction with the surgical result appears to be unrelated to the severity of the hand injury, as well. There is also no statistically significant association between HISS and frequency of pain, cold intolerance, sensation, DASH - Sport, anxiety and depression.

Clinically significant important correlations ($r \geq 0.5$, i.e. classified as `large` after Cohen) can be found throughout the matrix. For example, patients, who experience pain most frequently, have the highest DASH scores ($r = 0.67$). People who have a high level of depression are also the most anxious ($r = 0.77$). Strength in hand and finger and finger mobility have high correlations with manual labour ($r = 0.70$; $r = 0.72$, respectively).

| Variable | DASH | DASH-Sport/Art | FLZ-Gen LS | FLZ-Health | FLZ-Appr | HADS-Anxiety | HADS-Depres | BDDE-SR | FBeK-1 | FBeK-2 | HISS | Manual Labour | Mobility | Finger Strength | Sensa-tion | Cold Intol | Satis OP | Satis Work | Pain Fre-quency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DASH | 1 | | | | | | | | | | | | | | | | | | |
| DASH-Sport/Art | 0.74 | 1 | | | | | | | | | | | | | | | | | |
| FLZ-Gen LS | -0.35 | -0.30 | 1 | | | | | | | | | | | | | | | | |
| FLZ-Health | -0.44 | -0.37 | 0.73 | 1 | | | | | | | | | | | | | | | |
| FLZ-Appr | -0.19 | -0.19 | 0.48 | 0.47 | 1 | | | | | | | | | | | | | | |
| HADS-Anxiety | 0.38 | 0.48 | -0.47 | -0.59 | -0.29 | 1 | | | | | | | | | | | | | |
| HADS-Depres | 0.50 | 0.51 | -0.58 | -0.60 | -0.31 | 0.77 | 1 | | | | | | | | | | | | |
| BDDE-SR | 0.58 | 0.62 | -0.31 | -0.32 | -0.24 | 0.42 | 0.51 | 1 | | | | | | | | | | | |
| FBeK-1 | -0.28 | -0.39 | 0.52 | 0.45 | 0.57 | -0.44 | -0.50 | -0.42 | 1 | | | | | | | | | | |
| FBeK-2 | 0.07 | 0.13 | 0.11 | 0.05 | 0.04 | 0.07 | 0.00 | 0.12 | 0.15 | 1 | | | | | | | | | |
| HISS | 0.26 | 0.13 | 0.01 | 0.03 | -0.02 | 0.10 | 0.11 | 0.24 | 0.04 | 0.03 | 1 | | | | | | | | |
| Manual Labour | 0.68 | 0.47 | -0.33 | -0.32 | -0.21 | 0.26 | 0.43 | 0.45 | -0.29 | -0.10 | 0.24 | 1 | | | | | | | |
| Mobility | 0.50 | 0.43 | -0.21 | -0.24 | -0.22 | 0.19 | 0.32 | 0.36 | -0.31 | -0.06 | 0.28 | 0.72 | 1 | | | | | | |
| Finger Strength | 0.69 | 0.64 | -0.30 | -0.34 | -0.12 | 0.28 | 0.46 | 0.42 | -0.28 | -0.03 | 0.28 | 0.70 | 0.65 | 1 | | | | | |
| Sensation | 0.49 | 0.39 | -0.26 | -0.21 | -0.11 | 0.19 | 0.34 | 0.32 | -0.36 | -0.01 | 0.09 | 0.59 | 0.64 | 0.56 | 1 | | | | |
| Cold Intol | 0.40 | 0.32 | -0.06 | -0.09 | -0.10 | 0.15 | 0.24 | 0.18 | -0.07 | 0.15 | 0.16 | 0.41 | 0.35 | 0.36 | 0.47 | 1 | | | |
| Satis OP | -0.31 | -0.28 | 0.15 | 0.19 | 0.24 | -0.07 | -0.21 | -0.31 | 0.21 | -0.02 | 0.06 | -0.42 | -0.36 | -0.29 | -0.25 | -0.32 | 1 | | |
| Satis Work | -0.54 | -0.52 | 0.50 | 0.40 | 0.26 | -0.35 | -0.52 | -0.56 | 0.40 | 0.06 | -0.20 | -0.62 | -0.49 | -0.53 | -0.45 | -0.31 | 0.44 | 1 | |
| Pain Frequency | 0.67 | 0.62 | -0.37 | -0.36 | -0.11 | 0.42 | 0.46 | 0.48 | -0.24 | 0.18 | 0.13 | 0.50 | 0.35 | 0.56 | 0.45 | 0.47 | -0.23 | -0.50 | 1 |

FLZ- Gen LS = General Satisfaction of Life
FLZ-Appr = Outer Appearance
HADS-Depres = Depression
FBeK-1 = Attractiveness / Self - Confidence
FBeK -2 = Accentuation of Physical Appearance
Cold Intol = Cold intolerance
Satis OP = Satisfaction with Surgical Result
Satis Work = Satisfaction with Work Situation

Interpretation of the clinical importance of the correlation coeffcients (Cohen 1992):

| Correlation | Negative | Positive |
|---|---|---|
| Small | - 0.29 to - 0.10 | 0.10 to 0.29 |
| Medium | - 0.49 to - 0.30 | 0.30 to 0.49 |
| Large | - 0.50 to - 1.00 | 0.50 to 1.00 |

Table 37: Correlation matrix

### III.4.8 Regression - Analysis

#### *III.4.8.1 Regression Analysis of General Life Satisfaction*

While many variables have been shown to be related to FLZ - General Life Satisfaction, many of these are related to each other and so it is not easy to consider whether a variable is related to the main one of interests independent of other variables. It is possible to use multiple regressions to identify what variables are independently related to outcome. Both quantitative and dichotomous variables are being tested in the regression analysis.

Previously, it has been shown that the following variables are related to FLZ - General Life Satisfaction: FLZ - Health, FLZ - Outer Appearance, HADS - Anxiety, HADS - Depression, DASH, DASH - Sport / Performing Arts, BDDE - SR, FBeK - Attractiveness / Self - Confidence, ability to perform manual labour, strength in hand and finger, work satisfaction, hand dominance, employment status, income status, pain in hand and finger, frequency of pain, and the following sensory disturbances: cold, warm, totally numb, pressure sensation, and itching. All of these either have a correlation of + or - 0.3 or greater[♦] with FLZ - General Life Satisfaction or were shown to significantly relate to FLZ - General Life Satisfaction, using either t - tests or one - way analysis of variance.

At this point, the frequency of pain is being omitted as the dichotomous variable pain in hand and finger is also to be included. These are obviously highly correlated, so should not both be entered. The dichotomous variable is more robust and is therefore retained. Work satisfaction, employment and income status and DASH - Sports / Performing Arts are also omitted, as they are only available for 82, 88 or 96 patients, respectively. If included, it would mean that the regression analysis would only be carried out on 82 people, i.e. for all those with non - missing data for all variables. Inclusion would mean that important relationships may be missed.

DASH, HADS - Anxiety, HADS - Depression, BDDE - SR, FBeK - Attractiveness / Self - Confidence are all highly skewed which is not appropriate for entry into a regression analysis. It was therefore decided to dichotomise these variables. The two HADS - variables were dichotomised using the commonly used cut - off scores, i.e. patients were classified into normal ($\leq 7$) or $\geq 8$. Although, the BDDE - SR does have cut - off scores, only 2.5 % of the 118 patients scored above it. It is desirable to have at least 10 % of patients in a group. Therefore, DASH, BDDE - SR and FBeK -

[♦] The coefficient, at which level, according to Cohen, a medium correlation begins.

Attractiveness / Self - Confidence were dichotomised according to their median, achieving approximately 50% in each group.

The final set of variables that were available for selection into the regression model were: FLZ - Health, FLZ - Outer Appearance, HADS - Anxiety (dichotomised), HADS - Depression (dichotomised), DASH (dichotomised), BDDE -SR (dichotomised), FBeK - Attractiveness / Self - Confidence (dichotomised), ability to perform manual labour, strength in hand and finger, hand dominance, and the following sensory disturbances: cold, warm, totally numb, pressure sensation, itching and pain in hand and finger.

FLZ - General Life Satisfaction is normally distributed and so does not violate the assumptions made in carrying out a regression analysis, i.e. that the dependent variable is normally distributed. Given the high number of variables being entered, only main effects were entered not interaction terms.

The following variables were found to be significant predictors of FLZ - General Life Satisfaction: FLZ - Health and FLZ - Outer Appearance, pressure sensation and warm sensory disturbances. It was found that:

1. Increasing levels of FLZ - Health is related to increasing levels of FLZ - General Life Satisfaction. A 1 - point increase in FLZ - Health is related with a 0.47 point increase in FLZ - General Life Satisfaction (standard error = 0.06) or alternatively it can be said that a 10 - point increase in FLZ - Health is related to a 4.7 point increase in FLZ - General Life Satisfaction ($p < 0.001$).
2. Increasing levels of FLZ - Outer Appearance is related to increasing levels of FLZ - General Life Satisfaction. A 1 - point increase in FLZ - Outer Appearance is related with a 0.13 point increase in FLZ - General Life Satisfaction (standard error = 0.03) or alternatively it can be said that a 10 - point increase in FLZ - Outer Appearance is related to a 1.3 point increase in FLZ - General Life Satisfaction ($p < 0.001$).
3. People, who report a pressure sensory disturbance, scored on average 12.0 (standard error = 4.9) points lower on the FLZ - General Life Satisfaction variable, than those, who do not have that specific sensory disturbance ($p = 0.018$).
4. People, who report a warm sensory disturbance, scored on average 18.4 (standard error = 8.8) points lower on the FLZ - General Life Satisfaction variable, than those who do not have that specific sensory disturbance ($p = 0.040$).

The intercept value for this model is 39.3 (standard error = 5.5).

Using this intercept value and the other information above, it is possible to estimate the predicted value of FLZ - General Life Satisfaction for a range of hypothetical patients. This is important, because it means that General Life Satisfaction can be estimated in another group of similar patients by asking them to fill in the FLZ - Health - and the FLZ - Outer Appearance - questionnaire and answer the questions about sensory disturbances and pain.

For example, someone, who has a pressure sensation, but no warm sensation, scores 25 and 10 on FLZ - Health and FLZ - Outer Appearance, respectively, would on average score: 39.3 + (-12.0) + (25 x 0.47) + (10 x 0.13) = 40.35

The overall model was found to be significant, i.e. the model explained a significant proportion of the variation in the dependent variable ($F = 42.31$; $p < 0.001$).

The overall fit of the model was good ($R^2$ Adjusted = 58.5%). Collinearity - diagnostics indicated that multi - collinearity was not present. The tolerance values are well above 0.1.

It is possible that due to the strong relationship between the three FLZ measures, that they are encompassing the effect of other independent variables, which may be related to all the FLZ measures, this effect being confounded. Therefore, the regression analysis above was repeated but not making FLZ - Health and FLZ - Outer Appearance available for selection into the model.

The following variables were found to be significant predictors of FLZ - General Life Satisfaction: HADS - Depression (dichotomised), FBeK - Attractiveness / Self - Confidence (dichotomised), pain in hand and finger and warm sensory disturbances. It was found that:

1. People who scored 8 or above on HADS - Depression scored on average 29.4 (standard error = 9.5) points lower on the FLZ - General Life Satisfaction variable than those, who scored less than 8 on HADS - Depression ($p = 0.003$).
2. People who scored 13 or above on FbeK - Attractiveness / Self - Confidence scored on average 18.7 (standard error = 6.2) points higher on the FLZ - General Life Satisfaction variable than those, who scored 13 or above on FBeK - Attractiveness / Self - Confidence ($p = 0.003$).
3. People, who report pain in hand and finger, scored on average 18.8 (standard error = 6.2) points lower on the FLZ - General Life Satisfaction variable than those, who do not have pain ($p = 0.003$).
4. People, who report a warm sensory disturbance scored on average 24.4 (standard

error = 11.3) points lower on the FLZ - General Life Satisfaction variable than those, who do not have that specific sensory disturbance (p = 0.034).

The intercept value for this model is 74.2 (standard error = 5.7).

Using this information, it is therefore possible to estimate the predicted value of FLZ - General Life Satisfaction given a range of hypothetical patients.

For example, someone, who has pain but no warm sensation, scores 10 and 14 on HADS - Depression and FBeK - Attractiveness / Self – Confidence, respectively, would on average score: 74.2 + (-18.8) + (-29.4) + (18.7) = 44.8

The overall model was found to be significant, i.e. the model explained a significant proportion of the variation in the dependent variable, ($F = 14.57$; $p < 0.001$).

The overall fit of the model was good ($R^2$ Adjusted = 31.7 %). Collinearity diagnostics indicated that multi - collinearity was not present. The tolerance values are well above 0.1.

While this is a significant model, we can see that the overall fit is substantially lower than the first model, i.e. only 31.7 % of the variation in FLZ - General Life Satisfaction being accounted for, much lower, than when FLZ - Health and FLZ - Outer Appearance were included in the model.

### *III.4.8.2 Regression Analysis of Satisfaction with Health*

The variables related to FLZ - Health are the same as those related to FLZ - General Life Satisfaction, with the exception that hand dominance is not significantly related to Health. These variables have either a correlation of + or - 0.3 or greater[♣] with FLZ - Health or were shown to significantly relate to FLZ - Health using either t - tests or analysis of variance. Additionally, frequency of pain, work satisfaction, employment and income status, as well as DASH - Sports / Performing Arts have been omitted for the same reasons as for the regression for FLZ - General Life Satisfaction.

For the Health regression analysis, all the highly skewed outcome measures were dichotomised, using either the commonly used cut - off scores or the median values, as described for the FLZ - General Life Satisfaction regression analysis.

The final set of variables that were available for selection into the regression model were: FLZ - General Life Satisfaction, FLZ - Outer Appearance, HADS – Anxiety

[♣] The coefficient, at which level, according to Cohen, a medium correlation begins.

(dichotomised), HADS - Depression (dichotomised), DASH (dichotomised), BDDE - SR (dichotomised), FBeK - Attractiveness / Self - Confidence (dichotomised), ability to perform manual labour, strength in hand and finger, and the following sensory disturbances: cold, warm, totally numb, pain in hand and finger, pressure sensation, and itching.

FLZ - Health is normally distributed and does not violate the assumptions made in carrying out a regression analysis, i.e. that the dependent variable is normally distributed. Given the high number of variables being entered, only main effects were entered not interaction terms.

The following variables were found to be significant predictors of FLZ - Health: FLZ - General Life Satisfaction, HADS - Anxiety (dichotomised), and strength in hand and finger. It was found that:

1. Increasing levels of FLZ - General Life Satisfaction is related to increasing levels of FLZ - Health. A 1 - point increase in FLZ - General Life Satisfaction is related with a 0.69 point increase in FLZ - Health (standard error = 0.07) or alternatively it can be said that a 10 - point increase in FLZ - General Life Satisfaction is related to a 6.9 point increase in FLZ - Health ($p < 0.001$).
2. People, who scored 8 or above on HADS - Anxiety, scored on average 30.0 (standard error = 6.6) points lower on the FLZ - Health variable than those, who scored less than 8 on HADS - Anxiety ($p < 0.001$).
3. Decreasing amount of strength in hand and finger is related to decreasing levels of FLZ - Health, a 1 - point move on the Likert - Scale is related with a 5.4 point decrease in FLZ - Health (standard error = 2.5; $p = 0.030$).

The intercept value for this model is 43.7 (standard error = 9.9).

Using this information, it is therefore possible to estimate the predicted value of FLZ - Health given a range of hypothetical patients.

For example, someone, who scores 8 or above on HADS - Anxiety, reports ‘fairly bad` on Strength in Hand and Finger (3 on the Likert - Scale), scores 25 on FLZ - General would on average score: 43.7 + (-30.0) + (25x0.69) + (3x-5.4) = -19.75

The overall model was found to be significant, i.e. the model explained a significant proportion of the variation in the dependent variable ($F = 61.12$, $p < 0.001$).

The overall fit of the model was good ($R^2$ Adjusted = 60.7 %). Collinearity diagnostics indicated that multi - collinearity was not present. The tolerance values are well above 0.1.

It is possible that due to the strong relationship between the three FLZ measures, that they are encompassing the effect of other independent variables, which may be related to all the FLZ measures, this effect being confounded. Therefore, the regression analysis above was repeated but not making FLZ - General Life Satisfaction and FLZ - Outer Appearance available for selection into the model.

The following variables were found to be significant predictors of FLZ - Health: HADS - Depression (dichotomised), HADS - Anxiety (dichotomised), itching and totally numb sensory disturbances. It was found that:

1. People, who scored 8 or above on HADS - Depression, scored on average 46.5 (standard error = 12.8) points lower on the FLZ - Health variable than those, who scored less than 8 on HADS - Depression ($p < 0.001$).
2. People, who scored 8 or above on HADS - Anxiety, scored on average 27.5 (standard error = 10.0) points lower on the FLZ - Health variable than those, who scored less than 8 on HADS - Anxiety ($p = 0.007$).
3. People, who report itching, scored on average 34.0 (standard error = 10.0) points lower on the FLZ - Health variable than those, who do not have itching ($p = 0.001$).
4. People, who report a totally numb sensory disturbance scored on average 44.6 (standard error = 16.7) points lower on the FLZ - Health variable than those, who do not have that specific sensory disturbance ($p = 0.009$).

The intercept value for this model is 89.3 (standard error = 4.2).

It is therefore possible to estimate the predicted value of FLZ -Health given a range of hypothetical patients.

For example, someone, who has itchiness but no totally numb sensation, scores 10 and 14 on HADS - Depression and HADS - Anxiety, respectively, would on average score: $89.3 + (-34.0) + (-46.5) + (-27.5) = -18.7$

The overall model was found to be significant, i.e. the model explained a significant proportion of the variation in the dependent variable ($F = 20.5$; $p < 0.001$).

The overall fit of the model was good ($R^2$ Adjusted = 45.1 %). Collinearity diagnostics indicated that multi - collinearity was not present. Tolerance values are well above 0.1. While this is a significant model, we can see that the overall fit is substantially lower than the first model, i.e. only 45.1 % of the variation in FLZ - Health being accounted for, i.e. lower than when FLZ - General Life Satisfaction and FLZ - Outer Appearance were made available to the regression model.

# IV Discussion

## IV.1 Patients and Methods

### IV.1.1 Patient Group

From the hospital records, between 1976 and 2003, 934 patients were deemed eligible for inclusion into this study. All had severe or major injuries, as defined by the HISS. As this study analysed data from 1976 to 2003, it would appear that on average 35 patients with severe or major hand injuries are admitted to the rechts der Isar Hospital per year. During the study period, there were three major changes in the hospital data storage system. It is possible that during the transfer some information could have been lost.

The response rate to the 18 - page questionnaire was 43.7 % (128/293 patients). This must be interpreted with the understanding that an initial yes / no letter was sent to a larger group of 934 patients.

Of the 128 patients that filled in the 18 - page questionnaire, 10 patients did so incompletely and needed to be excluded.

The final sample of 118 patients represents 12.6 % of the original patient number (118/934). This relatively low patient number needs to be further explained:

37.6 % (351/934) of the original yes / no - letters, were returned `unbekannt verzogen`. Thus, over 1/3 of patients with major or severe HISS were not traceable. This is probably, because most of these patients changed their address one or more times during the period studied. Another possible reason may be that the national post code change in Germany (1993) led to difficulties in obtaining the correct patients` addresses.

A further 235 patients, although probably receiving the initial yes / no - letter, chose not to reply. This represents 25 % of the 934 patients. There are multiple reasons, why patients are unable to, or choose not to reply to questionnaire based surveys. Additionally, it has to be assumed that the majority of the 138 (138/293 = 47.1 %) patients, who did not reply to the questionnaire, although having indicated that they would be willing to do so, simply felt that this 18 - page questionnaire was too lengthy. Finally, 27 (27/293 = 9.2 %) questionnaires were returned by the post with a stamp `unbekannt verzogen`, as the patients had moved to a different address in the meantime, i.e. the 4 - month between ticking `yes` and receiving a questionnaire.

It was felt by the author that the final study group of 118 patients, despite being a relatively low percentage of the initially identified (934) patients following severe or

major hand injury, was large enough to be representative of the population of severe and major hand trauma patients treated at the rechts der Isar Hospital.

### IV.1.2 Inclusion Criteria

The hand injury severity scoring system (HISS) was useful to accurately place patients into different categories according to the severity of their hand injury. It did, however, limit patient inclusion, because all injuries proximal to and including the wrist were automatically excluded. Patient age of ≥ 15 years for inclusion into the study was chosen. A similar age cut - off was used in another study, assessing outcome following hand trauma in a European population. (Mink van der Molen, 2003, p 295) It was felt by the author, that patients younger than this would not be able to accurately complete the 18 - page questionnaire. This proved correct, as none of the ten incompletely answered questionnaires were by adolescents. Follow - up after hand injury, when assessing outcome, ranges widely in the literature. (Mink van der Molen, 2003, p 298, Saxena, 2004, p 516) The author decided on a minimum 12 month period after injury, because most patients would have rehabilitated sufficiently by then and thus be able to assess the impact their hand injury had on their quality of life.

It was important to exclude patients with pre - existing chronic upper limb pathology, and those with systemic diseases, as it was felt necessary in this quality of life study to have a population that was as homogenous as possible. Clearly, pre - existing upper limb pathology and chronic disease states will affect quality of life. Studying the impact of severe and major hand injuries on quality of life would be more difficult in these patients.

### IV.1.3 Hand Injury Severity Scoring System

In selecting a scoring system to record the severity of hand injuries, the author found weaknesses in all the methods reviewed. It was therefore decided that the HISS with its quantitative values would be the most comprehensive way of recording the hand injury information from the hospital notes of this patient population. The HISS has previously been successfully used when analysing outcome in patients with hand trauma, in both Europe and the USA. These studies found the HISS to be not only a good research tool, but also useful for functional assessment and long - term outcome. (Mink van der Molen, 1999, p 186; 2003, p 299; Saxena, 2004, p 516)

However, it has previously been noted that assessment of vascular injury is absent in the scoring system. (Mink van der Molen, 1999, p 185) It is for this reason that the

author included the definitions and classifications from the Replantation Committee of the International Society of Reconstructive Microsurgery (Biemer 1980), when addressing vascular impairment. Precise mechanisms of injury (i.e. crush, avulsion, burns, high - pressure injuries) are underestimated in the HISS system as well. (Mink van der Molen, 1999, p 185) The author has therefore included in the 18 - page questionnaire specific questions looking at mechanisms and instruments of injury. Criticisms about the integument being too heavily weighted (Saxena, 2003, p 516), are correct in the view of the author. It was also found that exclusion of carpal / wrist injuries led to a number of patients with very severe injuries being left out of the study group. This will obviously impact on the mean HISS of the population treated at the rechts der Isar Hospital. Finally, this scoring method is extremely time consuming and most certainly not a simple and quick scoring device. Therefore, in the opinion of the author, it has little place in the acute clinical setting. For research purposes, however, it is the best available system. It was felt to be the most appropriate scoring system for this hand injury study.

### IV.1.4 Questionnaire Design

The study questionnaire has been designed to measure quality of life in a group of patients that have rehabilitated from a severe or major hand injury.
Some authors describe their research as dealing with quality of life issues when in fact they have studied only one or two of the broad domains of quality of life (psychological, physical, functional ability, social). Such a study is not a true quality of life assessment. Some believe that not all domains are pertinent in every study. However, it is generally agreed that a number of domains need to be included to enhance accuracy. In this quality of life study the following domains have been analysed: Psychological, physical, ability to function, social and economical. In the opinion of the author, it was not relevant to assess the spiritual domain, suggested by Spilker. (Meier, 1997, p 321; Spilker, 1996, p 2)

| **Domain** | **Questionnaire relevance in order of importance** |
|---|---|
| Psychological | HADS, FLZ, BDDE - SR, FBeK, DASH |
| Physical | DASH, FLZ, General Part, FBeK |
| Ability to function | DASH, FLZ, General Part |
| Social | FLZ, BDDE - SR, General Part, DASH |
| Economical | FLZ, General Part |

Table 38: Quality of Life domains

The overlap of the questionnaires in assessing the various domains improves the accuracy by `triangulation`. This research method addresses a clinical problem from different, but complementary viewpoints. Triangulation has been previously shown to improve the validity of qualitative (subjective) research. (Greenhalgh, 1997, p 741)
This battery of validated tests evaluating each single domain, make it impossible to combine the test results into a single number. Therefore, the data in this study have been presented in a comparative manner. Each measure has been correlated with the same variables and therefore the results of the analysis of each measure have been indirectly compared with each other.
The author has established the relative importance of each individual test used to measure one or more aspects of quality of life before conducting the study. This practice ensured that data obtained from tests defined as minor are not later used to claim that a certain treatment (i.e. replantation versus terminalization) is more or less effective than another. Different test scales have been used to measure specific aspects of each domain. (Spilker, 1996, p 4)
The FLZ - General Life Satisfaction and FLZ - Health modules were considered by the author as more relevant. The reason for this is that the FLZ questionnaire is an overall measure of how satisfied people generally are with their life and health status. The FLZ measure is weighted and measures each single domain. The FLZ modules have therefore been analysed in greater depth.
Because of the multi - dimensionality, there are an almost infinite number of states of health existing, all with differing qualities. Translating the various domains and components of health into a quantitative value that indicates the quality of life is a complex task. (Testa, 1996, p 835) Because many of the components of quality of life cannot be observed directly, they are typically evaluated according to the classic principles of item - measurement theory (Lord, 1980, p 11). This theory proposes that there is a true quality of life value that cannot be measured directly, but that can be measured indirectly by asking a series of questions known as items, each of which measures the same true concept or construct. The patient answers are converted to numerical scores that are then combined to yield `scale scores`, which are combined to statistically computed summary scores (Ware, 1994, p 3:2). In this study, patients` answers have therefore been converted to numerical scores to make statistical analysis and comparisons possible. The items include objective (General Part) and subjective (5 x specific questionnaires) components, which is known to improve reliability, validity and sensitivity. (Testa, 1996, p 835)

If multi - dimensionality and subjectivity are combined in the assessment of quality of life, it is important to weight individual dimensions, particularly if a summary score is to be calculated. The FLZ - measure includes weighting for the relative importance of each dimension for the individual concerned. It makes a big difference psychologically, whether one is dissatisfied with an area of life one regards as unimportant or with an area one regards as important.

If quality of life is assessed by using questionnaires that place an overwhelming emphasis on one domain, e.g. functional capacity, then the wrong conclusions might be drawn. For example, one cannot imply that elderly people, even if their functional capacity is severely limited, have a poorer quality of life than younger people. Adjustments occur that preserve life satisfaction and therefore these people consider their quality of life as good even when there are severe limitations on their physical ability. Because quality of life is a dynamic construct (Allison 1997, p 228), it may change through such psychological phenomena as adaptation, coping, or expectation. Therefore, one cannot assume that by measuring the functional capacity of a person or a list of objective factors that at the same time one measures the quality of life. (Leplege, 1997, p 48)

It is for this reason that in this study, the quality of life scales have been balanced to assess various domains as equally as possible. (See Table 38)

DASH is strong on physical and functional assessment. HADS focuses purely on the psychological domain. The FLZ measure addresses each single domain. The BDDE - SR looks mainly at the social and psychological component of quality of life and the FBeK scales highlight the psychological and physical aspects.

The economic domain is another example of weighting quality of life domains incorrectly. It is usually included in quality of life studies in the USA (Schipper, 1996, p 16), but authors elsewhere feel that less emphasis is needed. An example that is frequently cited is that certain individuals, among them lottery winners, generally consider themselves much less happy than an outsider would expect. (Brickmann, 1978, p 917) On the other hand, many studies by social psychologists have related a high percentage of satisfied individuals, even among persons who clearly have major economic problems. (Glatzter, 1984, p397)

These examples of age and economic status can be explained by arguing that objectively negative factors in one`s life have relatively little effect on subjective quality of life: The so - called `satisfaction and well being paradox`. Quality of life can be influenced by personality structure, subjectively rated health, genetic factors, positive illusions, coping mechanisms, response shift, conceptualisation of meaning,

and processes of comparisons. This means that changes in reality (i.e. treatment after hand injury and modification of the value scales and expectation of the patient) can have effects on the quality of life of a person. However, only a small part of quality of life is determined by factors, like old age, gender, family status, education, and income. (Herschbach, 2002, p 144)

In this quality of life project, the economic domain is less emphasized in opposite to the other quality of life domains with only a portion of the FLZ questionnaire and some of the General Part questions addressing economic aspects.

The tests, employed in this study, to measure quality of life have been validated in the past and were found to be psychometrically sound. The measures were administered thoughtfully and analysed correctly to assess the quality of life of patients after severe and major hand injuries. (Fallowfield, 1996, p 421; Wood - Dauphinee, 1999, p 361)

In this quality of life analysis, the questionnaires fulfil the aspects of validity, because the essential areas of interest of this group of hand injury patients have been evaluated. The questions applied are sensitive and specific for the patients being assessed. The scales are reliable. The assessment of the quality of life of this group of patients is reproducible. The internal consistency is clearly demonstrated, as most of the questions move in the same direction and therefore reinforce each other. Each question adds additional precision and accuracy to the final result.

If a questionnaire meets these rigorous criteria, more meaningful conclusions can be made regarding outcome and comparison of treatment from this data than from results from non - validated questionnaires.

The author acknowledges that the clinical approach used for this study had methodological shortcomings:

Because of the cross - sectional nature of this study, responsiveness cannot be demonstrated, which is the ability of a measure to accurately detect change when it has occurred. Adaptation processes of the patients, living with their hand injury, are therefore not measured. (Herrschbach, 2002, p 149)

The study period is 27 years. Some patients are 20 years or longer after their hand injury and others little more than 12 months following hand trauma. Physical and emotional rehabilitation will vary widely between the patients in the study group. (Schipper, 1996, p 20)

The retrospective nature, with which the HISS was calculated, and the lack of a control group are other methodological weaknesses. (Ultee, 2003, p 459)

This study also suffered, as all other research projects that are based on self - administered questionnaires, from the fact that a large number of subjects and responses were missed. (Gyatt, 1993, p 623)

Although the scales have been shown to be individually practicable and well accepted by patients, the length of this 18 page questionnaire (combining the 5x outcome measures and the General Part) may have contributed to a decrease in the response rate.

Addressing each specific outcome questionnaire, a number of points need to be mentioned: The optional module about sport and performing arts was used for the DASH measure, because it was felt that these areas were under - represented in the other questionnaires. However, after the patients` data were analysed, it became clear that the work optional module may well have been the better choice as most of the patients` occupations involved manual labour.

The BDDE - SR was initially developed for the pre - operative setting. Its use as a screening instrument in the postoperative period has not been widely tested yet.

All three FLZ modules were included in this study. The third module of the FLZ, looking at outer appearance, is currently under development. The information gained from this study, looking at severe and major hand injuries, will form part of its validation process.

## IV.2 Results

### IV.2.1 General

A high proportion of the patients were married males in their late thirties, who had a basic school qualification and then learned a trade. The largest single group (19.5 %) were `casual` labourers without any regular employment. Together with the next three largest groups, i.e. automobile industry, wood trade, and farmers, these four groups comprised over 50 % of the total study group. Over half of the study group sustained a combined `cut - crush - avulsion` injury and almost 2/3 of injuries were caused by machinery. Circular saw injuries were particularly common (46.6 %). In over 50 %, the accident occurred during spare time activities. A similar incidence of leisure time hand injury (58 %) was found by Rosberg, looking at severe and major hand injuries (Rosberg, 2005, p 363)

The severe HISS category (HISS > 50) comprised 17.8 % of patients. The rest (82.2 %) had major hand injuries (HISS >100), according to the HISS definition.

The mean HISS of the 118 patients was 209.2 (range = 51 - 704). This was higher than most studies that had used the HISS. (Watts, 1998, p 488; Mink Van Der Molen,

1999, p 185; 2003, p 298; Saxena, 2004, p 513) The severity of injuries can be explained by the fact that only the worst hand injuries referred to rechts der Isar Hospital, a tertiary referral hand centre, were included in this study.

A total of 124 replantations were performed with 92 (74.2 %) successes. The 32 (25.8 %) digital replant failures can be partly explained by the mechanism of injury (cut - crush - avulsion) and the fact that 24 of these 32 failures (75 %) occurred in 17 patients, who had multi - digit injuries of particularly high severity (mean HISS of 294.4). It must also be remembered that in the early part of the study period (1976 - ), microsurgical techniques were very much in evolution. It is difficult to find comparative success rates for replantations in the literature. Other studies analyse different levels of amputation, different age groups, or combine the results of upper and lower limb replant procedures. Furthermore, the definitions for replantation and revascularisation vary between hand surgical centres around the world. (Biemer, 1982, p 57) Studies, which look at similar hand injury groups, report the following replant failure rates: 26 % (Morrison, 1978, p 128); 21 % (Scott, 1981, p 205); 20.6 % (Daoutis, 1992, p179); 21 % (Boyle, 2000, p 552).

The mean number of operations was 2.6. Fifteen patients (12.7 %) had five or more operations. This is to be anticipated, as 19.5 % had a HISS > 300. More severe hand injuries are likely to require secondary procedures, such as tenolysis, arthrodesis, scar contracture release, etc. 83 patients (70.3 %) spent a cumulative time of up to 4 weeks in hospital, 25 (21.2 %) 4 - 8 weeks, and 10 patients (8.5 %) more than 8 weeks. This long hospital stay reflects the severity of the injuries. It is also understandable that patients with higher HISS were more likely to be admitted for rehabilitation as well. 46.6 % of patients (55) were admitted for rehabilitation. The mean length of rehabilitation admission was 6.6 weeks. This length of stay was over 2 weeks longer than the admission length for rehabilitation in a similar hand injury group of patients. (Watts, 1998, p 487) The mean length to completed treatment was 9.6 months (0 - 120 months). This was longer than most other studies and again reflected the injury severity of this patient group. It is also evident that this mutilating hand injury group required a large amount of input from medical, nursing, and therapist staff.
The 118 patients were largely satisfied with their surgical results and overall 72 % considered their satisfaction to be ≥ 7 out of 10. Satisfaction with the surgical result is a complex interaction between the operation result itself, the patient`s assessment of

the quality of care received, the stage of rehabilitation of the patient and the patient`s psychological profile.
Patients completed the questionnaire 10.2 years (mean) after their hand injury (range 1 - 29 years).

The motor function and sensory components of this hand injury patient group were analysed separately:
Motor function was analysed by assessing strength in hand and finger, mobility and the ability to perform manual labour. Graphical analysis has already revealed close similarities in the patients` subjective responses. Clinically important correlations are confirmed between manual labour and strength in hand and finger ($r = 0.70$) and between manual labour and mobility ($r = 0.72$). Patients, expressing `fairly good` or better motor function, were as follows: Strength in hand and finger (67.8 %), ability to perform manual labour (70.3 %), and finger mobility (55.9 %).
The author expected poorer results, as the injury severity in this population was extreme. However, with a mean time interval of 10.2 years following trauma, the injuries will have healed, and patients will have rehabilitated and adapted.
Furthermore, it must be remembered that 25 % of the 934 patients eligible for inclusion did not reply and the final completion of the 18 - page questionnaire was by only 12.6 % of the eligible patients. It is a possibility that those patients, who were dissatisfied with the results, chose not to respond and excluded themselves from the study.
Sensory function was analysed in two ways: One question, addressed general sensory recovery, and four further questions assessed the presence of a variety of sensory disturbances. Clinically important coefficients ($r = 0.56 - 0.64$) were found between general sensory recovery and motor function. This should be interpreted with the understanding that neural injury in this patient population is largely at common digital and digital nerve level, i.e. purely sensory nerves. The motor recovery of the hand in this group is related to bony union, tendon healing and stiffness rather than re - innervation of hand intrinsic musculature in the majority.
The most frequently reported sensory abnormalities weather dependent discomfort, dullness and cold sensations occurred in over 40 % of the study group. Cold intolerance was analysed in some detail in this study. 95.8 % reported some sensitivity to cold temperatures. 87.3 % described this as being of moderate severity or worse. Cold intolerance is known to be more common in cooler climates (Weiland, 1977, p 7) and the Bavarian winters can be extreme. This is probably the reason, why

weather dependent discomfort and cold sensations were among the most frequently reported sensory disturbances. The reason for the high incidence of dullness is likely to be incomplete sensory recovery. Many patients had severe neural damage accompanying their hand trauma. With a mean population age of 37.4 years, incomplete sensory neural recovery was to be expected. (Green, 1999, p 1390)
Pain as a symptom is likely to have a big impact on the quality of life of individuals. Nearly half of the study group (48.3 %) experienced pain. This compares favourably with Boyle`s study, where 91 % of patients reported the presence of pain. However, their follow - up was shorter and pain is likely to improve over time. (Boyle, 2000, p 553) Pain had a clinically important correlation with manual labour ($r = 0.50$) and finger strength ($r = 0.56$). Using the hand for `power` tasks, may well stimulate more pain receptors. An inverse association between frequency of pain and work satisfaction existed as well ($r = - 0.50$). It is logical that patients who are frequently in pain would find it difficult to enjoy their work environment.

Relating the HISS to all these sensory disturbances and pain, no statistically significant difference could be found between those patients with abnormal sensations or pain and those without. It is interesting to note that sensory abnormalities and pain are as likely to occur in people with hand injuries of lower and higher degree. There is a lot of variability in the HISS as the sample had a wide variability in the severity of their hand injury. This may be masking the differences, meaning that because of the variability in HISS, it is more difficult to detect differences between those patients with and those without each abnormal sensation.

Analysis of work disability is important as returning to a contributing role in society has multiple benefits. (Christiansen, 1999, p 553) The injured worker makes the transition from patient to employee and begins to generate income for himself and his family again. The psychological benefit of this return to `normal` life, cannot be underestimated. The study population understandably had lengthy work disabilities. This was closely related to HISS ($p < 0.001$). However, it had been previously reported that there is limited correlation between severity of hand injury and subsequent psychological, social, and occupational adjustment. (Beasley, 1981, p 362; Kleinert, 1980, p 394; Lee, 1985, p 494; Beasley, 1986, p 396; Grunert, 1988 a, p 127; Meyer, 2003, p 42) In the opinion of the author, the severity of injury is not necessarily the most significant determinant of recovery and reintegration into

society. Valued occupation, supportive relationships, pre - accident mental, emotional, and physical states are all important in adaptation following hand injury.
61.5 % of patients in this study, employed at the time of injury, returned to work by six months. 87.5 % had returned by three years. The majority returned to their former work place with only five patients seeking different employment. These findings compare favourably to previous studies. (Johns, 1981, p 420; Boyle, 2000, p 555)
Most of these patients still earned the same income as before the hand injury (11.5 % slightly less and 2.5 % drastically reduced).
The majority of patients (67 %) were satisfied with their present work situation, rating ≥ 7 out of 10. A reason for the general satisfaction with the work environment is that most patients returned to their previous jobs on the same salary, despite having had a devastating hand injury. A small proportion (8.5 %) was extremely dissatisfied with their work, giving a rating of 0. However, 4 of these 7 patients were unemployed, when completing the questionnaire.

A balanced life style with time to relax, play sport, or pursue a hobby, are all important to quality of life. 2/3 of patients in this study felt that their spare time had been affected by the hand injury. Despite this, only 37 % were required to actually give up a spare time activity.

### IV.2.2 Outcome Questionnaires

Each of the five outcome questionnaires were analysed in the same manner in an attempt to enhance the accuracy of the study and to allow indirect comparison between these five measures: The outcomes were initially related to various socio - demographic groups, treatment types and lengths of time since injury. Then the measures were compared between those patients who had reported different sensory disturbances and those who hadn`t. Finally, the five outcome questionnaires were directly correlated with each other and with the available quantitative variables.
In this section of the discussion, all p - values are significant after Bonferroni correction, unless otherwise specified.

**DASH**

The DASH emphasizes functional outcome. The patients` scores in this study were highly skewed (median 12.9). Therefore, the median value was used for comparison with other data. The majority of the patients had surprisingly low DASH scores with a few outliers at the upper extreme. Comparing this with normative data from a non -

clinical working population in Germany (Jester, 2005, p 1079), unexpected similarities were found. Why the DASH scores from this study group of severe and major hand injuries may be similar to that of a healthy population is difficult to explain. Perhaps, during rehabilitation, patients learned how to use their uninjured hand better in order to compensate for the loss. After the patients had come to terms with their functional disability and returned to `normal` life (despite the fact that the injured hand certainly has a measure of continued disability), the combined use of injured and uninjured hand approaches normal values with regards to functional disability. This adaptation appears to be continuous over a long period of time.

The median DASH score for the patients, less than 3 years after injury, was 19.6. The median DASH value for those, who were 3 years or more following injury, was 12.5. The median value for the study group was 12.9. In a similar study, median DASH scores in the severe and major HISS groups were around 30 at three months, and 20 at 1 year. (Rosberg, 2005, p 363) The continual decline in DASH scores indicated the steady adaptation following injury until DASH scores reached a plateau, with scores approaching normative levels. This may also point to a weakness in the DASH measure, as functional disability certainly exists in this study group. The DASH scoring system allows for compensation by use of the uninjured limb, assisting devices, etc. As time elapses following injury, and more adaptation occurs, it appears that the functional disability (with regards to the hand injury) becomes more difficult to measure. This could also be the reason, why there was only a small correlation between HISS and DASH in this study. A similar weak correlation between HISS and DASH has previously been reported in another study, looking at outcome of hand trauma. (Mink Van Der Molen, 2003, p 299)

Analysing the DASH scores, functional ability differed significantly in patients whose employment ($p < 0.001$) and income status ($p < 0.001$) had changed after their hand injury. The DASH - optional module had similar findings: Employment ($p < 0.001$); income status ($p < 0.005$). Higher functional disability levels would be a reason, why patients either lost their jobs or changed to a lesser paid position.

It is interesting to note that the females were significantly ($p = 0.004$) more disabled in the sport / arts section, than in the DASH 30 - item measure. Maybe, females view sport and art as optional in their lives. The DASH 30 - item measure has more functions that are vital, when dealing with the activities of daily life.

Weather dependency ($p < 0.001$), cold sensation ($p < 0.001$) and cold intolerance ($r = 0.40$), presence of pain ($p < 0.001$) and pain frequency ($p = 0.67$), general sensory problems ($r = 0.49$), pressure ($p < 0.001$) and numbness ($p = 0.002$) were significantly

more found in patients with higher DASH scores. A high proportion of the patients in this study group relied on manual strength work. This may be the reason, why pain and pressure featured so prominently in the DASH related sensory disturbances. Furthermore, many patients, such as farmers and wood workers, would be exposed to weather extremes. These circumstances may well have also contributed to the influence of weather dependent sensory disturbances.
Impaired motor function (manual labour, mobility, strength in hand and finger) is strongly associated with high DASH scores (r = 0.50 - 0.69). Interestingly, motor function seemed less important clinically in the sports / performing arts arena in this patient group. High work satisfaction correlated highly with low DASH scores, i.e. people with disability of low degree enjoy work more (r = - 0.54).

The DASH, as a region - specific instrument, focuses on measuring the impact of the hand injury from the subjective perspective of the patient. It especially concentrates on attributes linked to the physical function dimension of quality of life. It appears from this study that despite severe and major hand injuries, the function of the majority of the patients, was not severely affected. In a minority of the group, however, the mutilating hand injuries have impacted significantly on their functional outcome.

**HADS**

HADS examines the level of anxiety and depression. The majority of patients in this severe hand injury group fell into the normal spectrum (≤ 7) for anxiety levels (median = 3.5) and depression levels (median = 2). As the results were highly skewed, the median values were used for comparison with normative data.
While some differences between the analysed variables have been found with respect to anxiety and depression, it is important to note that only a small percentage of people had borderline (≥ 8) or greater levels of anxiety (22.9 %) and depression (13.1 %) in this study. This difference between anxiety and depression might be partly explained by the fact that HADS - Anxiety is highest in patients aged 30 - 59. HADS - Depression scores, however, are said to be highest in older people. (Herrmann, 1997, p 25) The mean age of this quality of life study was 37.4 years.
Analysing the anxiety component, none of the socio - demographic groups, treatment types and time intervals since injury, showed significantly higher levels of anxiety. The anxiety levels are similar to the general German population, when comparing similar age groups for their median anxiety values. (Hinz, 2001, p 195)

Patients with frequent pain (r = 0.42) and pressure discomfort (p = 0.001) showed significantly higher levels of anxiety. Pain is well known to be associated with high anxiety states. (Tauschke, 1990, p 161; Morley, 1995, p 39)
Work satisfaction was negatively correlated with anxiety (r = - 0.35). Are these findings primarily related to the psyche of the patient or to the hand injury itself? The answer to this may lie in the analysis of the few outliers, who displayed severe anxiety states (≥ 15). Their mean DASH score was 77 (mean of study group 20.3) and their mean HISS score was 320 (mean of study group 209.3). These outliers do not reflect the findings in the entire patient group: The correlation between HADS - Anxiety and DASH is only of medium strength (r = 0.38). The relation between HADS - Anxiety and HISS is negligible (r = 0.10).

Examining the HADS - Depression results, the study group`s scores varied significantly according to the level of their income after the hand injury (p = 0.002). It is interesting to note that alterations in income level were significantly related to higher depressive, but not higher anxiety levels. Depression was also closely linked to work satisfaction (r = - 0.52) and DASH scores (r = 0.50). Thus, patients with higher functional disability had poorer job satisfaction, and were more depressed.
Sensory abnormalities (r = 0.34), pain frequency (r = 0.46), and motor function (p = 0.32 - 0.46) were also linked to depression. With these facts in mind, it is particularly pertinent to note that the median depression score for this study group was also similar to median normative values. (Hinz, 2001, p 195) The explanation may again lie with the few outlying patients.

It has been previously stated that severity of disease / injury itself is not necessarily positively related to HADS - Anxiety or - Depression scores. (Herrmann, 1997, p 25) Furthermore, it can be seen that there was no significant difference between the short (< 3 years) and longer (> 3 years) time intervals since injury with regards to anxiety (p = 0.920) and depression scores (p = 0.455), i.e. patients shortly after their injury did not display higher anxiety or depression levels.
It may therefore be concluded that the small group of patients (outliers) with severe anxiety and depression are likely to have had these states already prior to their hand injury. The hand trauma may well have unmasked an existing `anxiety and depression trait`, which then led to greater functional disability and poorer work satisfaction.
It may be possible to screen patients with the Hospital Anxiety and Depression - questionnaire shortly after injury. If they are identified as being at risk, they can be

selected for further psychological assessment and early appropriate treatment. Early intervention may improve outcome in patients with pre - existing psychological conditions.
The psychological domain, tested by HADS, appears to be little affected for the majority of patients with severe and major hand injuries.

**BDDE – SR**

The BDDE - SR questionnaire assesses how patients feel and perceive their bodies. The results were highly skewed (median 21.5). There are currently no normative data available yet from a representative population in Germany.
The majority of patients (97.5%) scored within the normal spectrum (< 63), which was to be expected.

It is the author`s view that working class men, the majority of patients in this study, are unlikely to exhibit psychological disturbances towards their own bodies. The findings from this questionnaire confirm this view. A small number of patients revealed manifest body dysmorphic behaviour (≥ 69). It was largely these patients, who also displayed high anxiety and depression states.

Analysing the variability in BDDE - SR scores, statistical significance was found between the groups for gender ($p < 0.001$), employment status ($p < 0.001$), and income status ($p = 0.002$) after injury. Pressure discomfort ($p < 0.001$), general sensory abnormalities ($r = 0.32$) and pain ($p < 0.001$) were found in patients with significantly higher levels of body dysmorhia.
Impaired motor function ($r = 0.36$ - $0.45$) and satisfaction with the surgical result ($r =$ - $0.31$) also influenced BDDE - SR scores. A large inverse correlation existed between work satisfaction and BDDE - SR scores ($r =$ - $0.56$), i.e. patients, who have a higher tendency towards this disorder, feel less happy with their work environment. There was no significant difference in BDDE - SR scores between patients, who were either < 3 years or > 3 years since injury ($p = 0.471$), with both groups lying within the normal spectrum.

This self report has contributed to the psychological and social domains. It largely confirmed the findings of the HADS questionnaire, i.e. that the majority of the study population has a normal psychological profile with a few outliers. The results of this

screening tool also revealed that the mutilating hand injuries did not adversely influence the patients` assessment of their own bodies.
It is likely that the majority of patients in this study did not have any pre - injury existing psychological deviation from the norm with regards to body perception.

**FLZ**

The FLZ measure assesses subjective quality of life. All three FLZ modules are normally distributed and therefore, the mean values will be used for comparisons.

The mean General Life Satisfaction score (69.1) indicates that the study group had slightly higher levels of satisfaction, when compared with normative data (Henrich, 2000, p 155; 2001, p 5). Income levels ($p < 0.001$) and work satisfaction ($r = 0.50$) were important to this group. Pain ($p < 0.001$) and pressure discomfort ($p < 0.001$) negatively influenced life satisfaction. Furthermore, the worse the ability to perform manual labour ($r = - 0.33$) and the worse the strength in hand and finger ($r = - 0.30$), the more dissatisfied the patients were.
There was no significant difference between the patients, who were < 3 years or > 3 years since injury ($p = 0.561$).
It is difficult to explain, why the patient group was at least as satisfied, if not more satisfied with life generally, than the normal population. Possible explanations include patient adaptation and high levels of work satisfaction.

The FLZ - General Life Satisfaction correlates with all other questionnaires on a clinically important `medium` or `large` scale (with the exception of FBeK - Accentuation of Physical Appearance). This indicates that many of the issues addressed in the FLZ - General Life Satisfaction measure are also examined in the other questionnaires. This method of one questionnaire supporting the findings of the other questionnaires by addressing an item from a slightly different perspective, adds accuracy to subjective studies (`triangulation`).

The mean score for FLZ - Health Satisfaction (66.8) was lower than the normative data (Henrich, 2000, p 155; 2001, p 5), indicating that this group of patients were not as satisfied with their health as the general population.
Factors affecting satisfaction with health included hand sensory disturbances, such as cold ($p = 0.001$), numbness ($p = 0.004$), pressure discomfort ($p = 0.002$), itching ($p = 0.001$) and motor abnormalities ($r = -0.32 - -0.34$), as well as pain ($p < 0.001$).

Work satisfaction had been shown to be more closely linked with General Life Satisfaction ($r = 0.50$) than with Health Satisfaction ($r = 0.40$), indicating that those happy with work and life generally may not be as satisfied with their health status. Health satisfaction was also influenced by income levels ($p < 0.001$).
Health scores did not differ significantly between patients who were less or more than 3 years since injury ($p = 0.979$), with both time intervals lying below normative levels.
It is quite understandable that patients, who have suffered mutilating hand injuries with incomplete motor and sensory recovery, are less satisfied with their health status. It seems, however, paradoxical that despite good functional recovery (DASH for study group with mean time since injury of 10.2 years approaching normative data), patients were less satisfied with their health. It must be remembered that patients with co - morbid factors and chronic health conditions were excluded from the study. Furthermore, analysing the items of the health module, only two of eight questions can be directly related to hand injury. The remaining six look at general health aspects, such as ability to relax, energy, and the ability to see and hear. FLZ - Health correlated strongly with FLZ - General Life Satisfaction, HADS - Anxiety and HADS - Depression. The analysis of these three measures revealed that the majority of patients fell within the normal spectrum. Therefore, the lower health satisfaction appears somewhat of a mystery. The few extreme outliers may be skewing the satisfaction with health.

The mean FLZ score for Outer Appearance was 29.4. No comparative or normative data exist for this variable, which was normally distributed for these hand injury patients. It appears that the satisfaction with outer appearance improved over time, as the patients, who were 3 years or more after their hand injury, scored higher levels in this module. However, the difference between these two time intervals was statistically not significant ($p = 0.248$)
Analysis has shown that people with different work qualifications showed significantly different satisfaction with their appearance ($p = 0.002$).
The fact that no other clinically `large` important correlations existed with this module (with the exception of an understandable correlation with FBeK - Attractiveness / Self - Confidence), is an indication that the quality of life of this hand injury group is unlikely to be affected by appearance.

The FLZ questionnaire, a subjective measurement tool, examines with its three modules all five dimension of quality of life. From the results, it can be seen that patients had, despite their mutilating hand injuries, high levels of general life satisfaction, lower than normal levels of health satisfaction, and possibly normal satisfaction with outer appearance.

**FBeK**

The FBeK questionnaire assesses peoples` subjective views of their own bodies.
As the measure about Attractiveness and Self - Confidence is highly skewed (median 13), the median value was used for comparison with normative data.
The scores of this module differed significantly between the various income groups after injury ($p = 0.001$). However, the patients` FBeK levels did not differ significantly with the presence of any of the sensory abnormalities or pain.
Medium strength correlations have been noticed between this module and general sensory problems ($r = - 0.36$), finger mobility ($r = - 0.31$), and satisfaction with work ($r = 0.40$).

Despite these findings, the results of this measure correlate favourably with the normative data from a large scale representative survey for similar age groups (Brähler, 2000, p 163), indicating that the group of severe and major hand injury patients had no deviation from the norm with regards to their self - confidence and attractiveness about their own bodies. The FBeK scores were the same in the shorter (< 3 years) and the longer (>3 years) time interval since injury, supporting the idea that the hand injury had no impact on attractiveness and self - confidence.

The data, collected on Accentuation of Physical Appearance, was normally distributed (mean 6.4). The mean value was therefore used for comparison with normative data. Females have been found to have significantly higher scores in this module ($p = 0.004$). Electrical sensation ($p = 0.001$) was the only sensory disturbance associated with higher scores. This module has only small correlations to any of the other variables.

The results from this FBeK section compare favourably with the normative data (Brähler, 2000, p 163), indicating that patients had no deviation from the norm with regards to Accentuation of Physical Appearance. There was also no statistically

significant difference between the mean values of patients, who were either less or more than 3 years following injury ($p = 0.118$).

It is the opinion of the author that attractiveness and physical appearance are closely linked with self - confidence. Self - perception of attractiveness and appearance are incorporated into the individuals` view of themselves at very young age. It is unlikely that patients that have rehabilitated from a hand injury will have a distorted attitude towards their own attractiveness and appearance. The findings of the FBeK questionnaire support this, although one could think that self - confidence may be affected, especially in females with mutilating hand injuries. This appears not to be the case in this patient group.

The FBeK questionnaire has contributed to the quality of life assessment in this study, by showing that physical appearance and self - confidence is unrelated to hand injury in most of the patients in this study.

The economic domain has been consciously underrepresented in the selection of the outcome measures by the author, as it has been previously argued that objectively negative factors play a small role for the subjective quality of life. Opinions differ as to the importance of economic factors, when assessing quality of life. (Spilker, 1996, p 2; Schipper, 1996, p 16)
From the results of this study, however, it appears that the economic domain is closely linked to the quality of life of this group of hand injury patients. In the following outcome questionnaires, the groups for income and employment, representing economic and financial stability, displayed statistically significant differences (after Bonferroni correction) in the levels of the specific measures being analysed:
**Employment status after injury:** DASH 30 item and optional module; BDDE - SR.
**Level of income after injury:** DASH 30 item and optional module; HADS Depression; BDDE - SR; FLZ - General Life Satisfaction; FLZ - Health; FBeK - Attractiveness / Self - Confidence.

Reduction in earnings below a certain level after the hand injury can be therefore associated with greater functional disability, higher levels of depression and body dysmorphia, greater dissatisfaction with life generally and health status, and impaired self - confidence.
The contribution that income levels make to the different outcome questionnaires is however more complex than this. It has been shown that income affects the psychological, physical, functional and of course economical domains in this patient group.
Perhaps the significance given to income levels by this group of patients is partly related to the current economic climate. The majority of this study group were labourers from a middle working class background at the time of injury. Many of these patients are currently employed, despite their mutilating hand injury, while the unemployment rate is particularly high in Germany at present. They could be both `happy` and satisfied that they are currently working, but also anxious (`existence fear`) that they may loose their jobs in the future.

It was surprising to the author that the patient group fared as well if not better than the general population in all outcome questionnaires, except the FLZ - Health.
It appears that the quality of life was little affected by the hand injury in the majority of patients.

### IV.2.3 Quality of Life of Replantations versus Terminalizations

One of the aims of this project was to try and compare the quality of life of patients that had replantations with patients that had undergone terminalizations. To the author`s knowledge, such a comparison between these two groups has not been done before.

It became apparent early on in the project that this may prove difficult, as many patients had complex injuries with both replantations as well as terminalizations often performed on the same hand. Therefore, the 118 patients were divided into four groups [Replant (45), Stump (29), Mixed (24) and Other Group (20)] to facilitate comparison.

The patients in the Replant Group all had successful digital or hand replantations performed. The Stump Group underwent one or more digital terminalizations. Both Replant and Stump Group patients had additional soft tissue and bony injuries as well. The Mixed and Other Groups were included for completeness in the analysis of the 118 patients and have been described in detail in the Results section.

The findings, comparing Replant and Stump Group have been tabulated in Table 39 to aid the reader. The Stump Group appeared to have sustained hand injuries with greater severity, as the HISS, length of hospital stay, period of work disability, and adverse impact on spare time are all higher than in the Replant Group. Recovery following injury also appears to be worse in the Stump Group with motor functional problems and sensory disturbances being more frequent. This group had also more pain and lower satisfaction with both the surgical result and the work situation.

Patients in the Replant Group were more likely to be admitted for rehabilitation. This is understandable as the goal of replantation is not survival alone, but restoration of function. (Kleinert, 1978, p 205; Urbaniac, 1983, p 508) Functional rehabilitation following replantation is usually more intensive than after terminalization procedures.

The outcome questionnaires show similar findings, with the Replant Group having an overall better outcome. Two notable exceptions are the results of the FLZ - Outer Appearance and the FBeK - Accentuation of Physical Appearance questionnaires.

In both, the Stump Group fared slightly better. It is difficult to explain, why patients with lost digits have more satisfaction with their appearance than those that still have 10 digits, unless the hand injury itself has little impact on self - perception of attractiveness.

The two groups were statistically compared whenever possible. The findings have been tabulated:

| Variables analysed | Significant after Bonferroni corrected post hoc comparisons | Replant Group (n = 45) | Stump Group (n = 29) |
|---|---|---|---|
| HISS | no | 169.1 (mean) | 226.3 (mean) |
| Hospital Stay Length (> 8 weeks) | no | 2.2 % | 10.3 % |
| In - Patient Rehabilitation | no | 44.4 % | 34.5 % |
| Motor Function (manual labour & strength in hand and finger: `bad` + `very bad` - responses | no | 20 % | 27.5 % |
| General Sensory Disturbances: `bad` + `very bad` - responses | no | 33.3 % | 41.4 % |
| Cold Intolerance: `fairly bad` +`severe` - responses | no | 62.2 % | 65.5 % |
| Presence of Pain | no | 37.8 % | 55.2 % |
| Satisfaction OP - Result | yes (p = 0.025) | 8.0 (mean) | 6.2 (mean) |
| Work Disability (> 1 year) | no | 5.6 % | 18.2 % |
| Work Satisfaction | no | 8.4 (mean) | 6.8 (mean) |
| Sport / Hobby given up | no | 20 % | 31 % |
| DASH 30 - item | no | 6.7 (median) | 14.2 (median) |
| DASH Sports / Arts | no | 6.3 (median) | 25.0 (median) |
| HADS - Anxiety | no | 3 (median) | 4 (median) |
| HADS - Depression | no | 1 (median) | 4 (median) |
| BDDE - SR | yes (p = 0.001) | 19 (median) | 24 (median) |
| FLZ - General Life Satisfaction | no | 75.9 (mean) | 65.8 (mean) |
| FLZ - Health Satisfaction | no | 72.0 (mean) | 66.9 (mean) |
| FLZ - Satisfaction - Appearance | no | 26.9 (mean) | 37.2 (mean) |
| FBeK - Attractiv/Self-Confidence | no | 14 (median) | 13 (median) |
| FBeK - Physical Appearance | no | 6.0 (mean) | 6.6 (mean) |

Table 39: Outcome of Replant versus Stump Group

It is the opinion of the author that patients in the Replant Group have a higher overall quality of life than patients in the Stump Group. However, it is difficult to quantify, how much more satisfied the Replant Group is compared with patients who have lost digits.

The reasons for higher life satisfaction in patients following replantations are multi - factorial: The correct patient needs to be chosen for the replantation procedure. Physiologic age, dominance of the extremity, number and location of involved digits,

general health of the patient, the physical condition of the amputated part, and the psychological stability of the patient, are all important. The patient`s occupation and wishes on replantation must also be evaluated before a decision on replantation is made. Furthermore, patient compliance and motivation are essential factors to consider.

The projected functional loss needs to be weighed against the potential functional restoration based on the anatomical level, magnitude of the injury and the associated tissue damage. All of these factors must be recognized and evaluated before a decision about treatment is made.

When a patient with an amputated body part presents to hospital, it is frequently assumed that replantation will be attempted. With the current level of expertise, it is technically possible for replantations to be performed for most amputations. The benefits of replantation have been widely studied and reported.

At present, single digit amputations at level of the annular pulleys in adults is considered by some to be a relative contraindication to digital replantation. It must be remembered that in the relatively recent past, flexor tendon repair at this level was associated with universally poor outcome. Advances in hand surgery and rehabilitation now make repair at this level a routine procedure, associated with good return of function. It is only through continued efforts that replantation of the more difficult injuries will lead to improved outcomes.

It has been previously found that every patient with both successful and unsuccessful replantations said that they would go through the procedure again if the situation arose and would not elect to have closure of the amputation stump. (Weiland, 1977, p 7) This study showed that patients with replantations are more satisfied with a higher quality of life than patients, who had terminalizations performed.

Surgeons should strive to re - attach amputated digits whenever it is medically safe to do so.

### IV.2.4 Regression Analysis

In this quality of life study many variables were related to each other to a greater or lesser degree. It was therefore necessary for the author to try to identify variables with the greatest impact for the quality of life of patients after severe and major hand injuries. This was performed using four multiple regression models.

The author chose FLZ - General Life Satisfaction and FLZ - Health as the dependent variables for the regression models, not only because they appeared to cover all the domains needed to assess quality of life, but also because these questionnaires are particularly well designed and validated. The modules are short, easy to read and understand, include grading of responses and weighted items.

The regression analysis fulfilled two important purposes:

1. It revealed the most important predictors of quality of life, when analysing General Life Satisfaction and Health.
2. It produced a simple formula, a regression equation that allows comparison with other severe and major hand injury patients. General Life Satisfaction or Satisfaction with Health can therefore be estimated in a relatively straightforward manner, and compared between patients using a numerical value.

The following variables were found to be significant predictors of FLZ - General Life Satisfaction:

With inclusion of FLZ - Health and Outer Appearance into the regression model:

- FLZ - Health;
- FLZ - Outer Appearance;
- Pressure discomfort;
- Warm sensory disturbances.

Without making FLZ - Health and Outer Appearance available for selection into the model:

- HADS - Depression;
- FBeK - Attractiveness / Self - Confidence;
- Pain in hand and finger;
- Warm sensory disturbances.

The following variables were found to be significant predictors of FLZ - Health:
With inclusion of FLZ - General Life Satisfaction and Outer Appearance into the regression model:

- FLZ - General Life Satisfaction;
- HADS - Anxiety;
- Strength in hand and finger.

Without making FLZ - General Life Satisfaction and Outer Appearance available for selection into the model:

- HADS - Depression;
- HADS - Anxiety;
- Itching sensations;
- Numbness.

The three FLZ modules, which belong to the same outcome measure, were designed to be complementary, and tried to cover all aspects of the domains relevant for quality of life assessment. When running the regression model on General Life Satisfaction, it was therefore unsurprising that FLZ - Health and FLZ - Outer Appearance were found to be significant predictors of General Life Satisfaction. A similar finding was noted, when FLZ - General Life Satisfaction and FLZ - Outer Appearance was made available for selection into the regression model, with FLZ - Health being the dependent variable.
This close relationship between outcome questionnaires was likely to alter the results of the regression models with regards to significant predictors of General Life Satisfaction and Satisfaction with Health. The difference in variables is clear to see.

The similarities in all four regression models include:

- The presence of sensory disturbances and / or motor function problems as significant predictors, which have therefore a large impact on quality of life.
- The absence of the DASH questionnaire as a predictor, which was not unexpected, as it is mainly a measure of functional disability and is therefore limited to the functional, physical domain of quality of life. This non - selection of the DASH measure by the regression models, despite the obvious importance of sensory (and motor) disturbances as predictors, may be explained by the fact that the DASH questionnaire places more emphasis on functional tasks requiring power,

compared with tasks, needing sensation (e.g. feeling different sized coins in one`s pocket).

When the FLZ modules were withheld from selection into the regression models, HADS - Depression emerged as a significant variable in predicting both General Life Satisfaction and Satisfaction with Health. This finding is not unexpected, as it was shown that Depression has a `large` clinically important correlation with most of the outcome questionnaires.

General Life Satisfaction in this hand injury study group is highly dependent on the patients` satisfaction with their health and appearance as well as self - confidence. Poorer life satisfaction is associated with depression and sensory disturbances, such as pain, pressure discomfort and warm sensory abnormalities.
Satisfaction with Health in this group is higher with increased strength in hand and finger, and the absence of sensory abnormalities, such as numbness and itching. Feelings of depression and anxiety impact negatively on health satisfaction. Employment and income status were not made available for the regression analysis as the full complement of 118 patients did not address these issues. However, these factors were clearly shown to influence quality of life.

This study on quality of life has proven to be a complex task. Multiple interrelated domains need subjective analysis, the answers to which only give an indirect glimpse at the quality of life of each of the patients. The findings of the regression analysis need to be interpreted with this in mind.

# V Summary

The study of quality of life has become increasingly important in the 21st century. Health care workers need evidence on which to base treatment strategies. Health funding is limited and even first world countries are struggling to find resources for new, ever more expensive therapies. Without proper quality of life assessment, progress in health care will be hampered. Accurate assessment of this broad ranging concept is difficult. Assessment of quality of life is complex and affected by multiple factors. The aim of the study was to assess as comprehensively as possible the quality of life of a group of hand injury patients. The Hand Injury Severity Scoring System was used to distinguish between the severities of the different injuries. This study initially sought to create a platform, by finding a working definition for quality of life, and how best to assess this concept in a group of patients with mutilating hand injuries. The available literature revealed that there are a number of domains that need to be studied, when evaluating quality of life. As this study was to be a postal survey, appropriate questionnaires were chosen to analyse each domain. A certain amount of overlap (triangulation) was planned. This has enhanced the accuracy of the study as is evidenced in the large and medium correlations, existing between most of the questionnaires, the exception being FLZ - Outer Appearance and FBeK - Accentuation of Physical Appearance.

The patients were recruited from the database of the rechts der Isar Hospital.
118 patients agreed to participate and completed the 18 - page questionnaire.
Demographic data, injury details, and treatment information were obtained.
Assessment of outcome was made with emphasis placed on motor and sensory recovery as well as work and spare time activity. Five different outcome questionnaires were used. Each of these questionnaires covered one or more of the quality of life domains. The FLZ questionnaire was given more weighting than the others, as it covered all the quality of life domains.

The results were analysed using a variety of statistical methods. The generation of a correlation matrix helped to compare the multiple variables.

The patient group fared as well if not better than the general population in all the outcome questionnaires with the exception of FLZ - Health.

Economic circumstances appeared to be an important factor for quality of life.
Ongoing motor and sensory abnormalities negatively impacted to a significant degree.
Four different regression models on General Life Satisfaction and Satisfaction with Health facilitated the identification of the most important quality of life predictors.

General life satisfaction, satisfaction with health, attractiveness and self - confidence, psychological disorders (anxiety and depression), as well as sensory and motor function abnormalities were found to be significant predictors of quality of life. These predictors were combined in mathematical formulae to broadly estimate general life satisfaction and satisfaction with health.
Additionally, patients, who had replantations performed, were compared with patients, who had terminalizations performed, in order to evaluate, if there was a quality of life difference. Patients with successful replants were shown to have a higher quality of life than those that required terminalizations.

Despite evidence of continued disability in the injured hand, the majority of patients had normal quality of lives. This is an impressive achievement in a group of patients with mutilating hand injuries and reflects the great adaptability of human beings. The ability to make the most of what one has to survive and prosper is evident in this patient group.

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## VII Page Questionnaire – Adnexe

### *Angaben zu Ihrer Person*

Bitte beantworten Sie die folgenden Fragen zu Ihrer Person **vollständig**.
Ihre Angaben werden streng vertraulich behandelt.

1. Alter: _____

2. Geschlecht:
   - ☐ männlich
   - ☐ weiblich

3. Familienstand
   - ☐ ledig
   - ☐ verheiratet
   - ☐ verwitwet
   - ☐ geschieden

4. Was ist Ihr höchster Schulabschluß?
   - ☐ Haupt- / Volksschulabschluß
   - ☐ Realschulabschluß (Mittlere Reife)
   - ☐ Fachhochschulreife
   - ☐ Abitur (allgemeine Hochschulreife)
   - ☐ noch in der Schulausbildung
   - ☐ kein Schulabschluß
   - ☐ anderer Schulabschluß, welcher? _____

5. Welches ist Ihre höchste abgeschlossene Berufsausbildung?
   - ☐ abgeschlossene Lehre
   - ☐ Handelsschule
   - ☐ Fachschulabschluß (z.B. Meister-, Technikerschule)
   - ☐ Fachhochschulabschluß
   - ☐ Universitäts-, Hochschulabschluß
   - ☐ noch in der Berufsausbildung (Auszubildender, Student)
   - ☐ kein beruflicher Abschluß
   - ☐ anderer Abschluß, welcher? _____

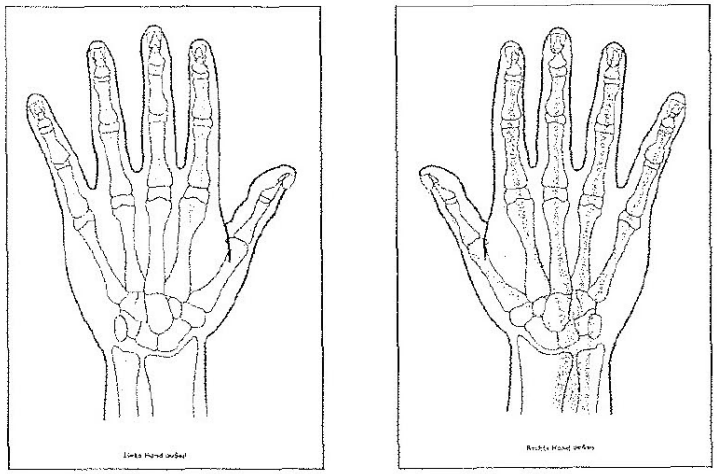
### *Lokalisation und Art der Verletzung*

1. Sind sie Rechts-oder Linkshänder?
   - ☐ Rechtshändler
   - ☐ Linkshändler

2. Was war bei Ihnen betroffen?

| | |
|---|---|
| ☐ rechte Hand | ☐ linke Hand |
| ☐ rechter Daumen | ☐ linker Daumen |
| ☐ rechter Zeigefinger | ☐ linker Zeigefinger |
| ☐ rechter Mittelfinger | ☐ linker Mittelfinger |
| ☐ rechter Ringfinger | ☐ linker Ringfinger |
| ☐ rechter Kleinfinger | ☐ linker Kleinfinger |

3. Wie weit war(en) der/die Finger abgetrennt?
   Bitte zutreffendes in den Handbogen einzeichnen.



4 Berichten sie den Unfallvorgang unter Berücksichtigung folgender Punkte:

4.1 Wie kam es zu der Verletzung?
- ☐ durch glatten Schnitt (z.B. Messer, Beil, etc.)
- ☐ durch Quetschung (z.B. in einer Presse geraten)
- ☐ durch Ausriss (z.B. Hängenbleiben des Fingers)
- ☐ durch schwere Verletzung (zusätzliche Schädigung von Finger und Hand = schwere Abquetschung - z.B. durch Kreissäge)

Sonstiges: _____

4.2 Schildern Sie bitte kurz ( in Stichworten) den Unfallhergang :

_____

_____

_____

_____

4.3 Wo ereignete sich der Unfall? (mehrere Antworten möglich )

- ☐ bei der Arbeit
- ☐ in der Freizeit
- ☐ beim Sport
- ☐ Verkehrsunfall
- ☐ im Urlaub

sonstige Möglichkeit : _____

## *Angaben zur Behandlung*

1. Bitte geben Sie Monats- und Jahreszahl der Verletzung an. ☐☐.☐☐☐☐

2. Wie viele Operationen waren bei Ihnen insgesamt notwendig ? ☐☐

3. Wie oft müssten Sie wegen der Verletzung stationär ins Krankenhaus ? ☐☐

4. Ist die Behandlung bereits beendet ?
   - ☐ Ja
   - ☐ Nein

   Wenn Ja, seit wann ? ☐☐.☐☐☐☐ (Monats- und Jahreszahl)

5. Sind noch weitere Maßnahmen geplant?
   - ☐ Ja
   - ☐ Nein

   Wenn Ja, welche?_____

## *Angaben zum Operationsergebniss*

1. Nehmen Sie bitte Stellung zu folgenden Aussagen:

| | sehr gut | gut | ziemlich gut | schlecht | sehr schlecht |
|---|---|---|---|---|---|
| Wie gut können Sie handarbeitliche Tätigkeiten ausführen ? | ☐ | ☐ | ☐ | ☐ | ☐ |
| Wie schätzen Sie ihre Fingerbeweglichkeit ein ? | ☐ | ☐ | ☐ | ☐ | ☐ |
| Wie beurteilen Sie ihre Kraft in Hand und Fingern ? | ☐ | ☐ | ☐ | ☐ | ☐ |
| Wie beurteilen Sie das Gefühl in ihren Fingern? | ☐ | ☐ | ☐ | ☐ | ☐ |

2. Falls Gefühlsstörungen vorhanden sind, wie würden Sie sie beschreiben ?
   - ☐ stumpf (d.h. Einschränkung des Tastsinns )
   - ☐ kribbeln
   - ☐ kalt
   - ☐ warm
   - ☐ völlig gefühllos
   - ☐ sonstige_____

3. Sind Sie gegen Kälte (z.B. bei niedrigen Außentemperaturen) empfindlich?
   - ☐ nein
   - ☐ wenig
   - ☐ mittelmäßig
   - ☐ ziemlich
   - ☐ sehr

4. Haben Sie Schmerzen in der Hand (auch nur gelegentlich)?
   - ☐ Nein
   - ☐ Ja

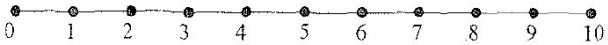
   Wenn ja, wie oft (1x/Woche, 2x/Woche, täglich,...)? _____

5. Haben Sie gelegentlich eine oder mehreren der folgenden Beschwerden?
   - ☐ Druck- oder Spannungsgefühl
   - ☐ Juckreiz
   - ☐ "elektrischer" Schlag bei Berührung der Narbe
   - ☐ Wetterfühligkeit
   - ☐ sonstiges _____
   - ☐ nein

6. Würden Sie aus heutiger Sicht die Operation (Wiederannähen der/s abgetrennten Finger/s) nocheinmal durchführen lassen ?

- ☐ *Ja*
- ☐ Nein
- ☐ Ich weiss es nicht

7. Mit dem Operationsergebniss insgesamt bin ich




*sehr unzufrieden* *sehr zufrieden*

## *Angaben zu Ihrer beruflichen Situation*

1. Wie lange waren Sie aufgrund Ihrer Handverletzung im Krankenhaus ?
   - ☐ bis 4 Wochen
   - ☐ 4 - 8 Wochen
   - ☐ Länger als 8 Wochen, nämlich ☐☐ Wochen

2. Wie lange waren Sie aufgrund Ihrer Handverletzung arbeitsunfähig?
   - ☐ bis 3 Monate
   - ☐ 3 - 6 Monate
   - ☐ 6 - 12 Monate
   - ☐ Länger als 12 ~~Jahr~~, nämlich ☐☐ Monate/Jahre

3. Wurden stationäre Rehabilitationsmaßnahmen durchgeführt?
   - ☐ Ja
   - ☐ Nein

   Falls ja, wie lange dauerte dieser Aufenthalt? ☐☐ Wochen

4. *Bitte geben Sie Ihre berufliche Situation*
vor der Verletzung und nach der Verletzung an

| | | |
|---|---|---|
| ☐ | berufstätig - Vollzeit | ☐ |
| ☐ | berufstätig - Teilzeit | ☐ |
| ☐ | *ausschließlich Hausfrau / Hausmann* | ☐ |
| ☐ | in Ausbildung / Umschulung | ☐ |
| ☐ | Rentner(in), Pensionär(in) | ☐ |
| ☐ | arbeitslos | ☐ |
| ☐ | anderes_____ | ☐ |

5. Welchen Beruf haben Sie vor der Operation ausgeführt?

_____

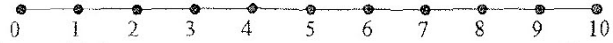
6. Konnten Sie nach der Handverletzung denselben Beruf in vollem Umfang wieder aufnehmen?
   - ☐ Ja
   - ☐ Nur teilweise
   - ☐ Nein

   Falls nein, welchen Beruf üben Sie zur Zeit aus?

   _____

7. Wie hat sich die Verletzung auf Ihr Einkommen ausgewirkt ?
   - ☐ *gleich geblieben*
   - ☐ gering vermindert
   - ☐ drastisch vermindert

8. Mit meiner jetzigen Arbeitssituation bin ich




sehr unzufrieden sehr zufrieden

## *Freizeitaktivitäten*

1. Hatte die Verletzung Einfluß auf ihre Freizeitgestaltung?
   - ☐ nein
   - ☐ wenig
   - ☐ mittelmäßig
   - ☐ ziemlich
   - ☐ sehr

2. Mußten Sie aufgrund der Verletzung auf eine bestimmte Freizeitaktivität verzichten ?

   - ☐ Ja
   - ☐ Nein

3. Wenn ja, bitte geben Sie an welche Aktivität/en Sie aufgeben mußten (z. B. Sport, Heimwerken, Instrument Spielen, usw.)

   _____

## DASH Fragebogen

Der vorliegende Fragebogen beschäftigt sich sowohl mit Ihren Symptomen als auch Ihren Fähigkeiten, bestimmte Tätigkeiten/
Aktivitäten auszuführen.
Bitte beantworten Sie alle Fragen gemäß Ihrem Zustand in der letzten Woche, indem Sie einfach die entsprechende Zahl einkreisen.
Es ist nicht entscheidend, mit welchem Arm oder welcher Hand Sie Ihre Tätigkeiten/Aktivitäten ausüben. Antworten Sie einfach entsprechend Ihren Fähigkeiten, egal wie Sie die Aufgaben meistern konnten.

### TEIL A:

*Bitte schätzen Sie Ihre Fähigkeiten ein, folgende Tätigkeiten/Aktivitäten in der letzten Woche ausführen zu können, indem Sie die entsprechende Zahl einkreisen.*

| | Keine | Wenig Schwierigkeiten | Merkliche Schwierigkeiten aber machbar | Erhebliche Schwierigkeiten, | Nicht möglich Schwierigkeiten |
|---|---|---|---|---|---|
| 1. Ein Marmeladen-, Einmach-, Honigglas öffnen | 1 | 2 | 3 | 4 | 5 |
| 2. Schreiben | 1 | 2 | 3 | 4 | 5 |
| 3. Schlüssel umdrehen | 1 | 2 | 3 | 4 | 5 |
| 4. Eine Mahlzeit zubereiten | 1 | 2 | 3 | 4 | 5 |
| 5. Eine schwere Tür aufstoßen | 1 | 2 | 3 | 4 | 5 |
| 6. Etwas auf ein Regal über Kopfhöhe stellen | 1 | 2 | 3 | 4 | 5 |
| 7. Schwere Hausarbeit (Boden putzen, Wände abwaschen) | 1 | 2 | 3 | 4 | 5 |
| 8. Garten- oder Hofarbeit | 1 | 2 | 3 | 4 | 5 |
| 9. Betten machen | 1 | 2 | 3 | 4 | 5 |
| 10. Eine Einkaufstüte oder Aktenkoffer tragen | 1 | 2 | 3 | 4 | 5 |
| 11. Schwere Gegenstände tragen (über 10 kg.) | 1 | 2 | 3 | 4 | 5 |
| 12. Eine Glühbirne über Kopf auswechseln | 1 | 2 | 3 | 4 | 5 |
| 13. Haare waschen oder fönen | 1 | 2 | 3 | 4 | 5 |
| 14. Den Rücken waschen | 1 | 2 | 3 | 4 | 5 |
| 15. Einen Pullover anziehen | 1 | 2 | 3 | 4 | 5 |
| 16. Ein Messer benutzen, um Lebensmittel zu schneiden | 1 | 2 | 3 | 4 | 5 |
| 17. Freizeitaktivitäten, die wenig körperliche Anstrengung verlangen (z. B. Karten spielen, Stricken usw.) | 1 | 2 | 3 | 4 | 5 |
| 18. Freizeitaktivitäten, bei denen Sie Ihren Arm mit mehr oder weniger Anstrengung benutzen, wie z. B.: Tennis, Heimwerken, Golf usw. | 1 | 2 | 3 | 4 | 5 |
| 19. Freizeitaktivitäten, bei denen Sie Ihren Arm frei bewegen (Badminton, Frisbee, Squash) | 1 | 2 | 3 | 4 | 5 |
| 20. Am Straßenverkehr teilnehmen oder öffentliche Verkehrsmittel benutzen, um von einem Platz zum anderen zu gelangen | 1 | 2 | 3 | 4 | 5 |
| 21. Sexuelle Aktivität | 1 | 2 | 3 | 4 | 5 |

22. In welchem Ausmaß haben Ihre Schulter-, Arm- oder Handprobleme Ihren normalen sozialen Kontakt zu Familie, Freunden, Nachbarn oder anderen Gruppen während der letzten Woche beeinflußt?

| Überhaupt nicht | Kaum | Merklich | Deutlich | Extrem |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

23. Waren Sie in der vergangenen Woche durch Ihre Schulter-, Arm- oder Handprobleme in Ihrer Arbeit oder anderen täglichen Aktivitäten eingeschränkt?

| *Überhaupt Nicht eingeschränkt* | *Kaum eingeschränkt* | *Merklich eingeschränkt* | *Deutlich eingeschränkt* | *Extrem* |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

### TEIL B:

*Bitte schätzen Sie die Schwere der folgenden Symptome während der letzten Woche ein. (Bitte kreisen Sie die entsprechende Zahl ein.)*

| | Keine | Wenig | Mittel | Erheblich | Extrem |
|---|---|---|---|---|---|
| 24. Schmerzen in Schulter, Arm, Hand | 1 | 2 | 3 | 4 | 5 |
| 25. Schmerzen in Schulter, Arme Hand, nachdem Sie eine bestimmte Tätigkeit ausgeführt haben | 1 | 2 | 3 | 4 | 5 |
| 26. Kribbeln (Nadelstiche) in Schulter, Arm, Hand | 1 | 2 | 3 | 4 | 5 |
| 27. Schwächegefühl in Schulter, Arm, Hand | 1 | 2 | 3 | 4 | 5 |
| 28. Steifheit in Schulter, Arm, Hand | 1 | 2 | 3 | 4 | 5 |

29. Hatten Sie in der letzten Woche Schlafstörungen wegen der Schmerzen in Schulter, Arm oder Hand?

| Keine Schwierigkeiten | Wenig Schwierigkeiten | Merkliche Schwierigkeiten | Erhebliche Schwierigkeiten | So viele Schwierigkeiten, daß ich nicht schlafen konnte |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

30. Durch meine Probleme in Schulter, Arm oder Hand fühle ich mich weniger fähig, mein Selbstvertrauen ist eingeschränkte und ich kann mich weniger nützlich machen.

| Stimme überhaupt nicht zu | Stimme nicht zu | Weder Zustimmung noch Ablehnung, Weiß nicht | Stimme zu | Stimme sehr zu |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**TEIL C: Sport- oder** *Musikinstrumente*

Die folgenden Fragen beziehen sich auf den Einfluß den Ihr Schulter-, Arm-, oder Handproblem auf das Spielen Ihres Musikinstrumentes oder das Ausüben Ihres Sports hatte.

*Wenn Sie mehr als ein Instrument spielen oder mehr als eine Sportart ausüben) so geben Sie bitte an) welches Instrument* oder welche Sportart für Sie am wichtigsten ist.

*Bitte kreisen Sie die Zahl ein, die Ihre körperlichen Fähigkeiten in der letzten Woche am besten beschreibt.*

Hatten Sie irgendwelche Schwierigkeiten:

| | Keine Schwierigkeiten | Wenig Schwierigkeiten | Merkliche Schwierigkeiten, aber machbar | Erhebliche | Nicht möglich Schwierigkeiten |
|---|---|---|---|---|---|
| 1. In der üblichen Art und Weise, Ihr Musikinstrument zu spielen oder Sport zu treiben? | 1 | 2 | 3 | 4 | 5 |
| 2. Wegen der Schmerzen in Schulter/Arm/Hand Ihr Musik-instrument zu spielen oder Sport zu treiben? | 1 | 2 | 3 | 4 | 5 |
| 3. So gut, wie Sie es gewohnt waren, Ihr Musikinstrument zu spielen oder Sport zu treiben? | 1 | 2 | 3 | 4 | 5 |
| 4. Ihre gewohnte Zeit mit dem Spielen Ihres Musikinstrumentes oder mit Sporttreiben zu verbringen? | 1 | 2 | 3 | 4 | 5 |

**„Körpermerkmal" = die Folgen der Handverletzung (Narbe, Amputationsstumpf, etc.)**

Trifft völlig zu (5)
Trifft ziemlich zu (4)
Trifft teils- teils zu (3)
Trifft wenig zu (2)
Trifft gar nicht zu (1)

1. Ich vermeide es, mein "Körpermerkmal" anzuschauen, um mich nicht aufzuregen..... □□□□□
2. Wenn ich über mein „Körpermerkmal" nachdenke, fühle ich mich schlecht ..... □□□□□
3. In der Öffentlichkeit bin ich wegen meines „Körpermerkmals" beunruhigt ..... □□□□□
4. *Aufgrund meines „Körpermerkmals" fühle ich mich durch andere* Personen als Mensch stets negativ beurteilt ..... □□□□□
5. Wenn fremde Personen mich wegen meines „Körpermerkmals" aufmerksam betrachten, fühle ich mich beunruhigt ..... □□□□□
6. Wegen meines Körpermerkmals` vermeide ich das Zusammensein mit nahe stehenden Personen wie z.B. mit Freunden, Bekannten oder Arbeitskollegen ..... □□□□□
7. Wegen meines Körpermerkmals" vermeide ich die Öffentlichkeit. □□□□□
8. Beim Zusammensein mit anderen (z.B. Familie, Freunden oder Arbeitskollegen) bin ich wegen meines , "Körpermerkmals" *Beunruhigt* ..... □□□□□
9. Wegen meines „Körpermerkmals" vermeide ich Spiegel..... □□□□□
10. Aufgrund meines „Körpermerkmals" bewerte ich mich als Mensch negativ ..... □□□□□
11. Es fällt mir schwer, nicht an mein „Körpermerkmal" zudenken ..... □□□□□
12. Ich habe den Eindruck, dass andere Personen mich wegen meines Körpermerkmals' aufmerksam betrachten ..... □□□□□
13. Ich denke, dass das Leben wegen meines ,.Körpermerkmals" nicht lebenswert ist ..... □□□□□

14. Bei negativen Bemerkungen von bestimmten Personen über mein „Körpermerkmal" fühle ich mich immer beunruhigt..... . ☐☐☐☐☐

15. Ich habe wegen meines „Körpermerkmals" sexuellen Kontakt vermieden ..... ☐☐☐☐☐

16. Die Beschäftigung mit meinem „Körpermerkmal" beeinträchtigt ... mich in meinem Privatleben..... ☐☐☐☐☐

17. Ich habe körperliche Aktivitäten in meiner Freizeit aufgrund meines Körpermerkmals" vermieden ..... ☐☐☐☐☐

18. Um die Aufmerksamkeit anderer Personen von meinem „Körpermerkmal" abzulenken, verändere ich bewusst meine Körperhaltung ..... ☐☐☐☐☐

# HADS-D

Sehr geehrte Patientin, sehr geehrter Patient!

Sie werden von uns wegen körperlicher Beschwerden untersucht und behandelt. Zur vollständigen Beurteilung Ihrer vermuteten oder bereits bekannten Erkrankung bitten wir Sie im vorliegenden Fragebogen um einige persönliche Angaben. Man weiß heute, daß körperliche Krankheit und seelisches Befinden oft eng zusammenhängen. Deshalb beziehen sich die Fragen ausdrücklich auf Ihre allgemeine und seelische Verfassung.
Die Beantwortung ist selbstverständlich freiwillig. Wir bitten Sie jedoch, jede Frage zu beantworten, und zwar so, wie es für Sie persönlich **in der letzten Woche** am ehesten zutraf. Machen Sie bitte nur ein Kreuz pro Frage und lassen Sie bitte keine Frage aus! Überlegen Sie bitte nicht lange, sondern wählen Sie die Antwort aus, die Ihnen auf Anhieb am zutreffendsten erscheint! Alle Ihre Antworten unterliegen der ärztlichen Schweigepflicht.

**Ich fühle mich angespannt oder überreizt**
- ☐ meistens
- ☐ oft
- ☐ von Zeit zu Zeit/gelegentlich
- ☐ überhaupt nicht

**Ich kann mich heute noch so freuen wie früher**
- ☐ ganz genau so
- ☐ nicht ganz so sehr
- ☐ nur noch ein wenig
- ☐ kaum oder gar nicht

**Mich überkommt eine ängstliche Vorahnung, daß etwas Schreckliches passieren könnte**
- ☐ ja, sehr stark
- ☐ ja, aber nicht allzu stark
- ☐ etwas, aber es macht mir keine Sorgen
- ☐ überhaupt nicht

**Ich kann lachen und die lustige Seite der Dinge sehen**
- ☐ ja, so viel wie immer
- ☐ nicht mehr ganz so viel
- ☐ inzwischen viel weniger
- ☐ überhaupt nicht

**Mir gehen beunruhigende Gedanken durch den Kopf**
- ☐ einen Großteil der Zeit
- ☐ verhältnismäßig oft
- ☐ von Zeit zu Zeit, aber nicht allzu oft
- ☐ nur gelegentlich/nie

**Ich fühle mich glücklich**
- ☐ überhaupt nicht
- ☐ selten
- ☐ manchmal
- ☐ meistens

**Ich kann behaglich dasitzen und mich entspannen**
- ☐ ja, natürlich
- ☐ gewöhnlich schon
- ☐ nicht oft
- ☐ überhaupt nicht

**Ich fühle mich in meinen Aktivitäten gebremst**
- ☐ fast immer
- ☐ sehr oft
- ☐ manchmal
- ☐ überhaupt nicht

**Ich habe manchmal ein ängstliches Gefühl in der Magengegend**
- ☐ überhaupt nicht
- ☐ gelegentlich
- ☐ ziemlich oft
- ☐ sehr oft

**Ich habe das Interesse an meiner äußeren Erscheinung verloren**
- ☐ ja, stimmt genau
- ☐ ich kümmere mich nicht so sehr darum, wie ich sollte
- ☐ möglicherweise kümmere ich mich zu wenig darum
- ☐ ich kümmere mich so viel darum wie immer

**Ich fühle mich rastlos, muß immer in Bewegung sein**
- ☐ ja, tatsächlich sehr
- ☐ ziemlich
- ☐ nicht sehr
- ☐ überhaupt nicht

**Ich blicke mit Freude in die Zukunft**
- ☐ ja, sehr
- ☐ eher weniger als früher
- ☐ viel weniger als früher
- ☐ kaum bis gar nicht

**Mich überkommt plötzlich ein panikartiger Zustand**
- ☐ ja, tatsächlich sehr oft
- ☐ ziemlich oft
- ☐ nicht sehr oft
- ☐ überhaupt nicht

**Ich kann mich an einem guten Buch, einer Radio- oder Fernsehsendung freuen**
- ☐ oft
- ☐ manchmal
- ☐ eher selten
- ☐ sehr selten

## FLZ Fragen zur Lebenszufriedenheit — 1. Allgemeiner Teil

Bei den folgenden Fragen geht es darum, wie **zufrieden** Sie mit Ihrem Leben und mit einzelnen Aspekten Ihres Lebens sind. Außerdem sollen Sie angeben, wie **wichtig** einzelne Lebensbereiche (z.B. Beruf oder Freizeit) für Ihre Zufriedenheit und Ihr Wohlbefinden sind.

Bitte beantworten Sie **alle** Fragen, auch diejenigen, die scheinbar nicht auf Sie zutreffen: Wenn Sie z.B. keinen Partner haben, können Sie bei der Frage nach der "Partnerschaft" trotzdem angeben, wie wichtig Ihnen das wäre und wie zufrieden Sie mit der derzeitigen Situation (ohne Partner) sind.

Lassen Sie sich nicht davon beeinflussen, ob Sie sich im Augenblick gut oder schlecht fühlen, sondern versuchen Sie, bei Ihrer Beurteilung **die letzten vier Wochen** zu berücksichtigen.

Bitte kreuzen Sie zunächst an, **wie wichtig** jeder einzelne Lebensbereich für Ihre Zufriedenheit insgesamt ist. Bevor Sie beginnen, schauen Sie bitte erst alle Bereiche an.

| Wie **wichtig** ist (sind) für Sie ... | nicht wichtig | etwas wichtig | ziemlich wichtig | sehr wichtig | extrem wichtig |
|---|---|---|---|---|---|
| 1. Freunde / Bekannte | 1 | 2 | 3 | 4 | 5 |
| 2. Freizeitgestaltung / Hobbies | | | | | |
| 3. Gesundheit | | | | | |
| 4. Einkommen / finanzielle Sicherheit | | | | | |
| 5. Beruf / Arbeit | | | | | |
| 6. Wohnsituation | | | | | |
| 7. Familienleben / Kinder | | | | | |
| 8. Partnerschaft / Sexualität | | | | | |

Bitte kreuzen Sie nun an, wie **zufrieden** Sie in den einzelnen Lebensbereichen sind.

| Wie **zufrieden** sind Sie mit ... | un-zufrieden | eher un-zufrieden | eher zufrieden | ziemlich zufrieden | sehr zufrieden |
|---|---|---|---|---|---|
| 1. Freunden / Bekannten | 1 | 2 | 3 | 4 | 5 |
| 2. Freizeitgestaltung / Hobbies | | | | | |
| 3. Gesundheit | | | | | |
| 4. Einkommen / finanzielle Sicherheit | | | | | |
| 5. Beruf / Arbeit | | | | | |
| 6. Wohnsituation | | | | | |
| 7. Familienleben / Kinder | | | | | |
| 8. Partnerschaft / Sexualität | | | | | |
| Wie zufrieden sind Sie mit Ihrem Leben **insgesamt** wenn Sie alle Aspekte zusammennehmen? | | | | | |



## FLZ Fragen zur Lebenszufriedenheit — 2. Gesundheit

Im folgenden ist der Bereich "Gesundheit" in verschiedene Aspekte unterteilt. Sie sollen auch hier wieder angeben, wie **wichtig** Ihnen einzelne Aspekte sind, und wie **zufrieden** Sie damit sind.

Bitte beantworten Sie **alle** Fragen. Lassen Sie sich nicht davon beeinflussen, ob Sie sich im Augenblick gut oder schlecht fühlen, sondern versuchen Sie, bei Ihrer Beurteilung die letzten **vier Wochen** zu berücksichtigen.

Bitte kreuzen Sie zunächst an, wie **wichtig** jeder einzelne Aspekt für Ihre Gesundheit ist. Bevor Sie beginnen, schauen Sie bitte erst alle Aspekte an.

| Wie **wichtig** ist (sind) für Sie ... | nicht wichtig | etwas wichtig | ziemlich wichtig | sehr wichtig | extrem wichtig |
|---|---|---|---|---|---|
| 1. Körperliche Leistungsfähigkeit | 1 | 2 | 3 | 4 | 5 |
| 2. Entspannungsfähigkeit / Ausgeglichenheit | | | | | |
| 3. Energie / Lebensfreude | | | | | |
| 4. Fortbewegungsfähigkeit (z.B. gehen, Auto fahren) | | | | | |
| 5. Seh- und Hörvermögen | | | | | |
| 6. Angstfreiheit | | | | | |
| 7. Beschwerde- und Schmerzfreiheit | | | | | |
| 8. Unabhängigkeit von Hilfe / Pflege | | | | | |

Bitte kreuzen Sie nun an, wie **zufrieden** Sie mit den einzelnen Aspekten sind.

| Wie **zufrieden** sind Sie mit Ihrer (Ihrem) ... | un-zufrieden | eher un-zufrieden | eher zufrieden | ziemlich zufrieden | sehr zufrieden |
|---|---|---|---|---|---|
| 1. Körperlichen Leistungsfähigkeit | 1 | 2 | 3 | 4 | 5 |
| 2. Entspannungsfähigkeit / Ausgeglichenheit | | | | | |
| 3. Energie / Lebensfreude | | | | | |
| 4. Fortbewegungsfähigkeit (z.B. gehen, Auto fahren) | | | | | |
| 5. Seh- und Hörvermögen | | | | | |
| 6. Ausmaß von Angst | | | | | |
| 7. Ausmaß von Beschwerden und Schmerzen | | | | | |
| 8. Unabhängigkeit von Hilfe / Pflege | | | | | |

**FLZ$^{M}$ Fragen zur Lebenszufriedenheit** — Äußere Erscheinung

Bei den folgenden Fragen geht es darum, wie **zufrieden** Sie mit Ihrem Aussehen bzw. Ihrer äußeren Erscheinung und mit einzelnen Körperteilen sind. Außerdem sollen Sie angeben, wie **wichtig** einzelne Körperteile (z.B. Augen oder Gesäß) für Ihre Zufriedenheit mit Ihrem Aussehen sind.

Bitte beantworten Sie **alle** Fragen und lassen Sie sich nicht davon beeinflussen, ob Sie sich im Augenblick gut oder schlecht fühlen.

Bitte kreuzen Sie zunächst an, **wie wichtig** jeder einzelne Körperteil für Ihre Zufriedenheit mit dem Aussehen ist. Bevor Sie beginnen, schauen Sie bitte erst alle Aspekte an.

| Wie **wichtig** ist (sind) für Sie Ihre / Ihr ... | nicht wichtig | etwas wichtig | ziemlich wichtig | sehr wichtig | extrem wichtig |
|---|---|---|---|---|---|
| 1. Kopfhaare | 1 | 2 | 3 | 4 | 5 |
| 2. Ohren | | | | | |
| 3. Augen | | | | | |
| 4. Nase | | | | | |
| 5. Mund | | | | | |
| 6. Zähne | | | | | |
| 7. Gesichtsbehaarung | | | | | |
| 8. Kinn / Hals | | | | | |
| 9. Schultern | | | | | |
| 10. Brust / Busen | | | | | |
| 11. Bauch | | | | | |
| 12. Taille | | | | | |
| 13. Hüfte | | | | | |
| 14. Penis / Vagina | | | | | |
| 15. Gesäß | | | | | |
| 16. Oberschenkel | | | | | |
| 17. Füße | | | | | |
| 18. Hände | | | | | |
| 19. Haut | | | | | |
| 20. Körperbehaarung | | | | | |
| 21. Größe | | | | | |
| 22. Gewicht | | | | | |



**FLZ$^{M}$ Fragen zur Lebenszufriedenheit** — Äußere Erscheinung

Bitte kreuzen Sie nun an, wie **zufrieden** Sie mit den einzelnen Körperteilen sind.

Bitte beantworten Sie auch hier wieder **alle** Fragen.

| Wie **zufrieden** sind Sie mit Ihrer / Ihrem / Ihren ... | un-zufrieden | eher un-zufrieden | eher zufrieden | ziemlich zufrieden | sehr zufrieden |
|---|---|---|---|---|---|
| 1. Kopfhaaren | 1 | 2 | 3 | 4 | 5 |
| 2. Ohren | | | | | |
| 3. Augen | | | | | |
| 4. Nase | | | | | |
| 5. Mund | | | | | |
| 6. Zähnen | | | | | |
| 7. Gesichtsbehaarung | | | | | |
| 8. Kinn / Hals | | | | | |
| 9. Schultern | | | | | |
| 10. Brust / Busen | | | | | |
| 11. Bauch | | | | | |
| 12. Taille | | | | | |
| 13. Hüfte | | | | | |
| 14. Penis / Vagina | | | | | |
| 15. Gesäß | | | | | |
| 16. Oberschenkeln | | | | | |
| 17. Füßen | | | | | |
| 18. Händen | | | | | |
| 19. Haut | | | | | |
| 20. Körperbehaarung | | | | | |
| 21. Größe | | | | | |
| 22. Gewicht | | | | | |

Wie zufrieden sind Sie mit Ihrem Aussehen **insgesamt**, wenn Sie alle Aspekte zusammennehmen?

Bei diesem Fragebogen geht es um Ihren Körper, d.h. wie Sie ihn wahrnehmen und empfinden, womit Sie zufrieden oder aber nicht zufrieden sind.

Lesen Sie bitte die auf den folgenden Seiten aufgeführten Aussagen durch und entscheiden Sie, ob für Sie die jeweilige Aussage stimmt oder aber nicht stimmt und machen Sie ein Kreuz in eines der beiden Kästchen.

Bei einigen Aussagen wird es Ihnen manchmal schwerfallen sich hierzu zustimmend oder aber ablehnend zu verhalten. Versuchen Sie sich dennoch spontan auf das festzulegen, was Ihnen als erstes in den Sinn kommt.

| | stimmt | stimmt nicht |
|---|---|---|
| • Ich nehme mir Zeit für Körperpflege. | ☐ | ☐ |
| • Ich bin mit meinen Geschlechtsmerkmalen zufrieden. | ☐ | ☐ |
| • Ich kenne die typischen Gesten vieler meiner Bekannten. | ☐ | ☐ |
| • Viele Leute machen zuviel Aufhebens um ihren Körper. | ☐ | ☐ |
| • Ich neige dazu, meinen Körper zu verbergen. | ☐ | ☐ |
| • Die äußere Erscheinung sagt viel über einen Menschen aus. | ☐ | ☐ |
| • Die Vorstellung, andere sehen mich nackt, bereitet mir Unbehagen. | ☐ | ☐ |
| • Ich schaue häufig in den Spiegel. | ☐ | ☐ |
| • Ich bin mit meinem Gewicht und mit meiner Größe zufrieden. | ☐ | ☐ |
| • Mein Äußeres hat mich schon daran gehindert, mit anderen in Kontakt zu kommen. | ☐ | ☐ |
| • Ich reagiere stark auf die körperliche Ausstrahlung von anderen. | ☐ | ☐ |
| • Ich wünsche mir einen anderen Körper. | ☐ | ☐ |
| • Ich betrachte mich oft und gern. | ☐ | ☐ |
| • Ich bin mit meinem Aussehen zufrieden. | ☐ | ☐ |
| • Es verunsichert mich, wenn irgend etwas an meinem Äußeren nicht so ist, wie es sein sollte. | ☐ | ☐ |
| • Ich bin mit meiner Figur zufrieden. | ☐ | ☐ |
| • Ich möchte genau wissen, was in meinem Körper vorgeht. | ☐ | ☐ |
| • Wenn ich nicht gut aussehe, fühle ich mich unwohl. | ☐ | ☐ |
| • Ich bin attraktiv. | ☐ | ☐ |

FBeK

| | stimmt | stimmt nicht |
|---|---|---|
| • Ich kann mir nur schwer vorstellen, daß andere mich anziehend finden. | ☐ | ☐ |
| • Manchmal habe ich Wut auf meinen Körper. | ☐ | ☐ |
| • Ich berühre mich oft sehr liebevoll. | ☐ | ☐ |
| • Duschen oder ein Bad nehmen ist für mich mehr als nur eine Reinigungsmaßnahme. | ☐ | ☐ |
| • Ich bin mit meinem Körper zufrieden. | ☐ | ☐ |
| • Ich reagiere sensibel auf Körpergeruch. | ☐ | ☐ |
| • Manchmal verspüre ich Ekel mir selbst gegenüber. | ☐ | ☐ |
| • Ich weiß, daß andere mich gern betrachten. | ☐ | ☐ |
| • Ich fühle mich in meinem Körper zuhause. | ☐ | ☐ |
| • Wenn jemand etwas Negatives über mein Aussehen sagt, trifft es mich sehr stark. | ☐ | ☐ |
| • Ich bin stolz auf meinen Körper. | ☐ | ☐ |
| • Mein Aussehen ist mir wichtig. | ☐ | ☐ |
| • Ich achte darauf, daß mein Körper bekommt, was er bracht. | ☐ | ☐ |