Biomechanical loading test on reconstructed mandibles with fibular, iliac crest or scapula graft: a comparative study.

Advantages and disadvantages of the three most commonly-used bone grafts for mandibular reconstruction are widely known, but biomechanical experimental studies are rare. We have done loading tests on cadaveric mandibles reconstructed with fibular, iliac crest, and scapular grafts using 3 different osteosynthesis systems to detect and compare their primary stability. Loading tests were done on mandibles with grafts from the fibula and iliac crest and published previously. A 4.5cm paramedian L-type defect was reconstructed with scapula using 2 monocortical non-locking plates, 2 monocortical locking plates, or a single bicortical locking plate/fracture gap in 18 human cadaveric mandibles. These were loaded on to the "Mandibulator" test bench and the movement of fragments in 3 dimensions was assessed and quantified by a PONTOS® optical measurement system. Comparison of the osteosynthesis groups showed that the miniplate was significantly superior to the 6-hole TriLock® plate for both fibular and iliac crest grafts. The fibular graft gave greater stability than the iliac crest and scapular grafts for all 3 osteosynthesis systems. All bony specimens offered sufficient resistance to mechanical stress within the recognised range of biting forces after mandibular reconstruction, independently of the choice of bone graft and osteosynthesis system used.
Anatomical and surgical advantages need to be taken into account when choosing a graft. Stability can be maximised with a fibular graft, and further optimised by enlarging the binding area by using the “double barrel” method. Computer simulated experiments could segregate factors that biased results, such as morphological differences among cadavers.