Abstract:
In the treatment of midface fractures, the fragments are immobilized using screws and plates for osteosynthesis until reunion has occurred. This method involves drilling holes for the insertion of the screws, which can be associated with additional fracturing of the corresponding bone owing to the complex architecture and thin layers of facial bone. To alleviate this problem, new adhesive techniques for fixing the plates for osteosynthesis have been investigated, mitigating the detrimental effects of screw hole drilling. In the present experimental study, the strength of this adhesive bond and its resistance to hydrolysis were investigated. To determine the adhesive bonding strength, a tension test was implemented. Osteosynthesis plates with screw holes 1.3 mm in diameter were fixed to cortical bone samples of bovine femur using ultraviolet (UV) light-curing polymethylmethacrylate bone cement. To facilitate bonding, the surface of the bone was conditioned with an amphiphilic bonding agent before cementing. UV light curing was implemented using either a conventional UV unit, such as is used in dentistry, or with a specialized UV unit with a limited emission spectrum but high luminosity. Reference control samples were prepared without application of the bone bonding agent. After this procedure, the samples were stored for 1 to 7 days at 37°C.
submerged in 0.9% saline solution before being subjected to the tension test. Without the bone bonding agent, the bonding strength was 0.2 MPa. The primary average bonding strength at day 0 was 8.5 MPa when cured with the conventional UV unit and 14 MPa for the samples cured with the specialized UV unit. An almost constant average bond strength of 8 and 16 MPa was noted for all samples stored up to 7 days after curing with the conventional and specialized UV unit, respectively. With the development of a new bone bonding agent, a method is now available to promote the bonding between the hydrophilic bone surface and the hydrophobic polymethylmethacrylate bone cement by creating an interlayer that is beneficial for adhesion. In the present in vitro study, the strength of this bond and its resistance to hydrolysis were investigated. This new method could have clinical bearing in cases in which conventional fixation with screws and plates is limited, such as can occur in comminuted fractures. The observed average bonding strengths of 8 to 16 MPa support the implementation of this technique in nonload-bearing regions such as the midface, facilitating immobilization until the bone reunion is complete.