Evaluation of Pre-Bent Miniplates in Fixation of Le Fort 1 Advancement Osteotomy with the Finite Element Method

Fatih Mehmet Coskunses¹, Bahadir Kan¹, Ibrahim Mutlu², Talip Çelik²
¹Department of Oral and Maxillofacial Surgery, Kocaeli University, Kocaeli, Turkey
²Department of Mechanical Education, Kocaeli University, Kocaeli, Turkey

Objective
Stability of segment after Le Fort 1 osteotomy attracted researcher's interest by the time that the surgical concept was convinced. The pre-bent plates are ultimate modification of plate systems in craniofacial surgery which have two right angles with different lengths for using in maxillary advancement surgery. Finite element Analysis (FEA) enabled researchers to evaluate the treatment of facial fractures and usage of technique in evaluating plating techniques has been confirmed by different studies with different models.

Methods
3D maxilla bone was scanned via CT images obtained from a male patient by means of cone beam computed tomography-CBCT. Conventional Le fort 1 osteotomy with 5 and 10 mm advancement were performed on both cortical and trabecular bone using Surgical Simulation Module of Mimics software. 1.7 mm Leibinger standart orthognatic 5 holes L Plates and 1.7 mm Leibinger orthognatic advancement 11 holes Pre-bent plates were adapted to fragments with the advancement of 5 and 10 mm.

Results
Displacement of the segment, Von Mises (VM) stresses (titanium miniplates and screws) and Maximum principal (MP) stresses (bone) for each configuration of plates and screws according to ordinary two miniplates technique and one pre-bent Leibinger miniplate for Le Fort 1 osteotomy are evaluated.

Conclusions
Pre-bent plates would be a good alternative to conventional two plates except in maxillary advancement surgeries exceeding 5mm forward movement. Surgical aims that need advancements exceeding 5mm or vertical position changes in still controversial and further studies are needed.

Keywords: Le Fort 1 osteotomy, pre-bent plates, Finite element Analysis