Assessment of Three Bilateral Sagittal Split Osteotomy Techniques with Respect to Mandibular Biomechanical Stability by Experimental Study and Finite Element Analysis Simulation

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Abstract：*Background*：No consensus has been reached on the ideal location for the lateral osteotomy cut in bilateral sagittal split osteotomy (BSSO) from the perspective of biomechanics. We assessed three BSSO techniques concerning mandibular biomechanical stability with experimental study and finite element analysis (FEA) simulation, and compared the study types. Methods：In the experimental study, 30 polyurethane-based synthetic mandibles were used. Pairs of model sets (n=5 models/set) were processed by using any of the following techniques：⑴ Trauner-Obwegeser (TO) method, ⑵ Obwegeser original (Ob) method, and ⑶ Obwegeser-Dal Pont (OD) method. In all methods, the distal segments were advanced by 5 mm parallel to the occlusal plane, and then reconstructed with bilateral titanium plates along Champy's line. All models were exposed to compression loads of up to 70 N at the central incisors and right first molars. In the FEA simulation, a 3-D FEA model was constructed from computed tomography (CT) data, and osteotomy was simulated by using any of the three BSSO techniques. A compressive load (10-70 N with 10-N increments) was applied to the central incisors and right first molar perpendicular to the occlusal plane. In both studies, central incisor and right first molar displacements on loading were used to assess mechanical stability after BSSO. Additionally, the differences in mechanical stresses developing in the right screw-plating system were examined. *Results*：Under every magnitude of incisal and molar loading, the OD method showed the least displacement；the results of both study types were in good agreement. In the FEA simulation, under 70-N incisal and molar loading, the OD method showed the least von Mieses stress in the screw-plating system. *Conclusions*：The OD method results in greater mechanical stability than the other two techniques. FEA is a useful method for estimating mandibular stability.

Key words：**Finite element analysis**；**Bilateral sagittal split osteotomy**；**Biomechanical stability**；**Champy's lines of ideal osteosynthesis**