Optimisation in multi-implant placement for completely edentulous mandibles

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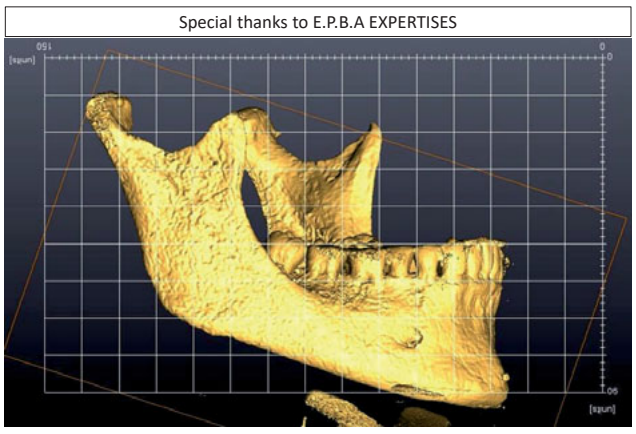
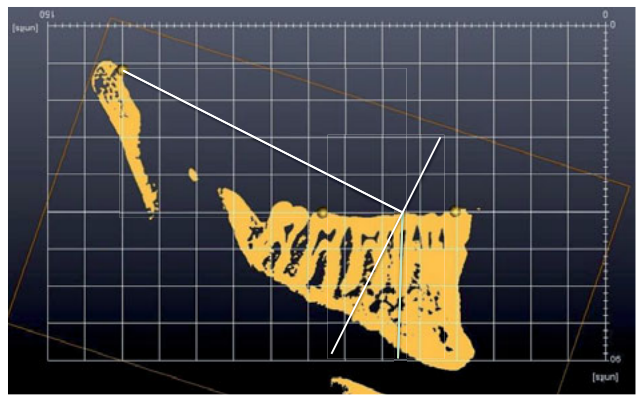




TOOTH	8	7	6	5	4	3	1
Angle between the line perpendicular to the closing radius and the axis of the mandibular tooth	**12.7** ± 9.2	**18.7** ± 5.3	**24.6** ± 4	**22.4** ± 3.7	**20.5** ± 4.4	**12.6** ± 5.6	**0.5** ± 8.7
Half mandible	108	211	209	203	195	211	504 (Orthlieb)

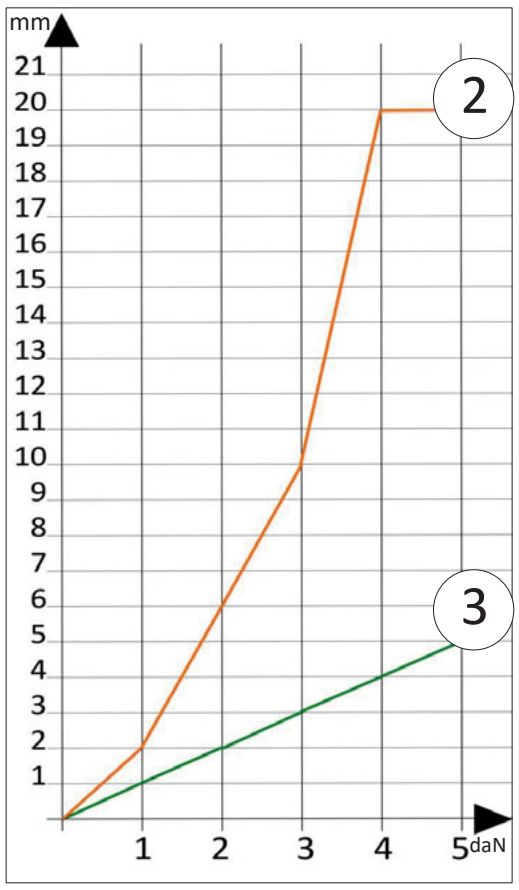
Abstract

Although implants connections limit the effects of excessive occlusal forces, it seems obvious, according to the laws of elementary biomechanics, that the vertical axis resultant of mandibular implant systems should be aligned to an ideal closing axis perpendicularly to the closing radius. Consequently, three approaches (theoretical, experimental, and clinical) are used to propose a new way of positioning the implants for the mandibular implant-supported fixed dental prosthesis.

The objective of this poster is to present a new approach while maintaining the principle of orthogonality at the closing radius. The theoretical part was supported by a cone beam computed tomography (CBCT) study on 211 half mandibles (from Vienna collection – R. Slavicek); the poster presents the experimental part)

Introduction

For a mandibular complete prosthesis with bilateral posterior cantilevers fixed on four implants, three theoretical ways of positioning dental implants can be proposed. These simulations, in three sketches, aim to determine the occlusal forces applied to the 4 dental implants with respect to the occlusal plane.



System	Test 1 : Loading at **1 daN**	Test 2 : Loading at **2 daN**	Test 3 : Loading at **3 daN**	Test 4 : Loading at **4 daN**	Test 5 : Loading at **5 daN**
System 2	Deformation **2 mm**	Deformation **6 mm**	Deformation **10 mm**	Deformation **20 mm** BREAKING	
System 3	Deformation **1 mm**	Deformation **2 mm**	Deformation **3 mm**	Deformation **4 mm** STABLE	Deformation **5 mm** STABLE

Simulation 1 : 4 implants parallel and perpendicular to the occlusal plane
Simulation 2 : 2 implants tilted posteriorly by 30 degrees and 2 implants perpendicular to the occlusal plane
Simulation 3 : 2 implants tilted posteriorly by 30 degrees and 2 anterior implants tilted anteriorly by 30 degrees to counterbalance the posterior implants.
To conclude, simulation 3 generates antagonistic forces, which tend to balance the simulation.
The posteriors implants are always the most requested because of the cantilever.

Objective

The objective of this simulation is to propose a different position for anterior implants, by tilting them forward, to counterbalance the distal inclination of the posterior implants.

MATERIALS AND METHODS

Simulation 1 was abandoned because it appears to be not very interesting from a mechanical point of view.
The hypothesis for simulations 2 & 3 must be tested by theoretical experimentation.
A comparative experimental modelling between simulation 2 and 3 is proposed by the use of a load tank placed on a bridge whose pillars would be angulated according to the system studied. The load tank is progressively heavier throughout the experiment. The posterior cantilever is deliberately reduced, and the load tank is slightly off-centered posteriorly and encroaches on the cantilever.

RESULTS :

DISCUSSION

Simulation 3 proposes a mandibular implant-supported fixed dental prosthesis on 4 implants but with 2 anterior implants tilted buccally to counterbalance the classical tilting of posterior implants. Indeed, for better mechanical resistance, it seems logical that the posterior angulation should be compensated by an anterior angulation of equivalent but opposite value to maintain a resultant perpendicular to the occlusal plane. Globally, the implant-prosthetic unit axis of resistance must be close to perpendicular to the closing radius.

REFERENCES

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