

3 D finite element analysis of stresses in a mandibular removable partial denture with attachments

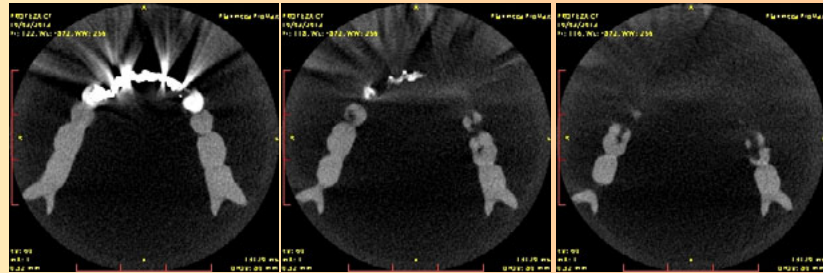


Oana-Cella Andrei, Livia-Alice Tănăsescu, Constantin Dăguci, Mircea-Horia Țierean, Ruxandra Mărgărit

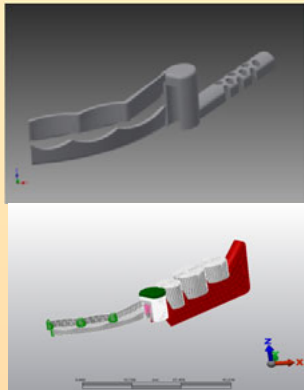
Faculty of Dentistry, „Carol Davila” University of Medicine and Pharmacy, Bucharest, Romania, Faculty of Dentistry, Craiova, Romania, and Faculty of Materials Science and Engineering, Transilvania University, Braşov, Romania

Introduction: During use, removable partial dentures move in directions and with magnitudes depending on the Kennedy class of the edentulous situation and on the size, direction and point of application of masticatory forces transmitted to the denture. These movements can harm the soft and hard tissues and also the denture, especially in free-end saddle situations. **The aim** of this study is to examine the distribution of stresses on a mandibular removable partial denture with attachments under occlusal forces using finite element method analysis.

Material and method: A class I Kennedy mandibular removable partial denture with extracoronary attachments was put in a CT scan, and the images were used to achieve a 3-dimensional model using Autodesk Inventor software. First, the 3D model of half of the denture was developed, and then the whole denture using the “mirror” technique was obtained. On this model, forces both in the long axis of the teeth and in the bucco-lingual direction were applied. All materials were assumed to be homogeneous, isotropic and having linear elasticity.

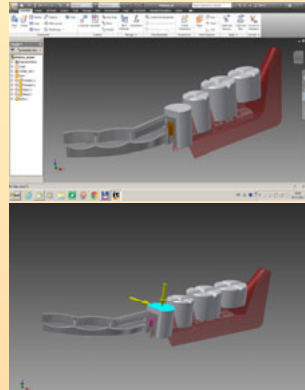


3D Model frame work component



Mesh denture

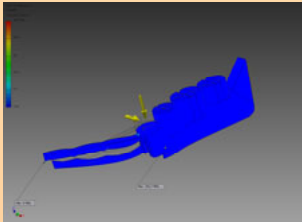
3D Model - denture



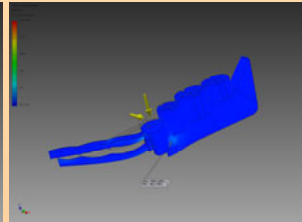
Application of forces at the level of M1

Results and discussion: masticatory forces create displacements, tensions and specific deformation in the denture’s structure. The study demonstrates the effect of sagittal tipping of the free-end saddle dentures under the occlusal load, compared to the ideal situation in which the dentures wouldn’t suffer any displacement. The saddle deformation is higher in the extreme distal area where there is only acrylic compared to the mesial area where the saddle is metalo-acrylic. The greatest deformation was reported on the matrix of attachment.

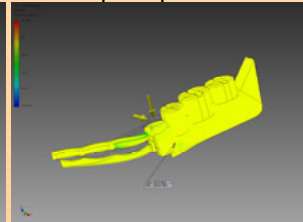
Von Mises stress



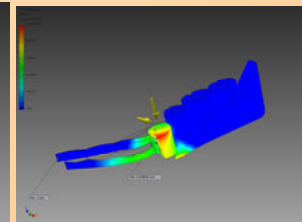
1-st principal stress



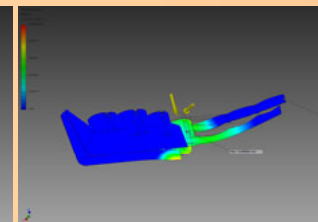
3-rd principal stress



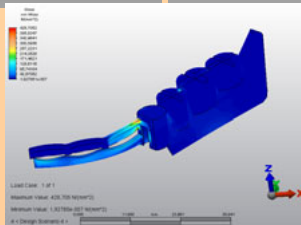
Displacement vestibular view



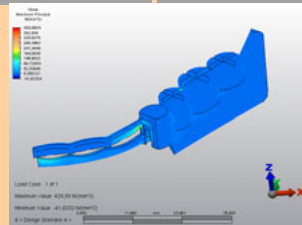
Displacement oral view



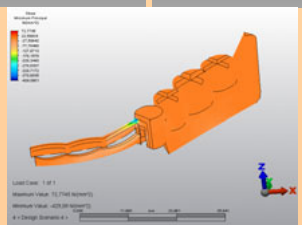
Denture with saddle constraint



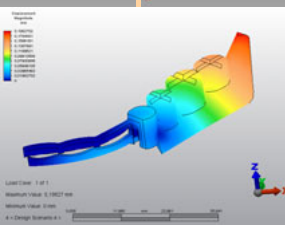
Von Mises stress



Stress maximum principal



Stress minimum principal



Displacement

Denture without saddle constraint

Conclusions: Through a proper design, the removable partial denture with attachments is able of dealing with almost all displacement trends.

Correspondence address:
Tanasescu Livia Alice
Faculty of Dental Medicine
Removable Prosthetic Dept.
Ionel Perlea Street 12
010209 Bucharest
ROMANIA

This poster was submitted by **Dr. Oana-Cella Andrei, Dr. Livia-Alice Tănăsescu, Dr. Constantin Dăguci, Mircea-Horia Țierean and Dr. Ruxandra Mărgărit**

Date/Event/Venue
24 – 27 April 2014
19th Congress of Balkan
Stomatological Society
Belgrade, Serbia