Numerical investigation of telescopic retained mandibular overdentures

L. Sandu[1], F. Topala[1], S. Porojan[1], N. Faur[2], A. Podariu[1]

[1] *"V. Babes" University of Medicine and Pharmacy Timisoara, Romania.*
[2] *Politehnica University Timisoara, Romania.*

INTRODUCTION: The telescopic overdenture is one possible solution for prosthetic rehabilitation for a partially dentate arch with few remaining teeth. Dentures supported by telescopic crowns are an alternative for snap or bar retained dentures [1-3]. The system of double crowns consists of the male component of attachment, patrix or inner crown, which is cemented to the abutment tooth, and the female component of attachment, matrix or outer crown, which is the removable part of the attachment [4]. The finite element analysis was conducted to assess the effect of the conical double crowns taper on the stress distribution in the fixed and removable frameworks.

METHODS: The 3D models of two mandibular canines were modelled using literature data. The abutment teeth were prepared with different tapers (between 4 and 10 degree), to allow comparing the influence of the taper on stress distribution in the attachment components. The overdenture framework was connected to the outer crowns of the canines. The geometrical models were generated using Rhinoceros (McNeel North America) NURBS (Nonuniform Rational B-Splines) modelling program. The finite element models were obtained by importing the solid models into ANSYS finite element analysis software (Ansys Inc., Philadelphia, USA). All the nodes on the external surface of the teeth roots were constrained in all directions. A displacement of 0.5 mm was applied on the distal end of the removable framework, to simulate the displacement toward the ridge during functions. Von Misses equivalent stresses were calculated in the double crowns and removable framework in condition of varying preparation angles of the teeth.

RESULTS: The maximal equivalent stress values were not significantly different for the investigated preparation angles. Only the distribution of the stresses varied, stress areas increased with the increase of the angle. Stresses were located in the cervical part of the inner crowns (Fig. 1), mesial and distal, and distal the outer crowns in the removable framework (Fig. 2).

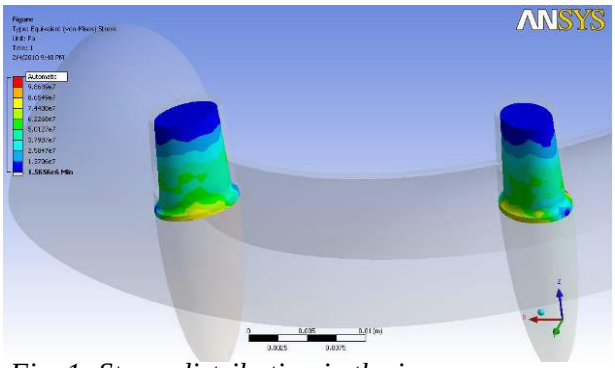

Fig. 1: Stress distribution in the inner crowns.

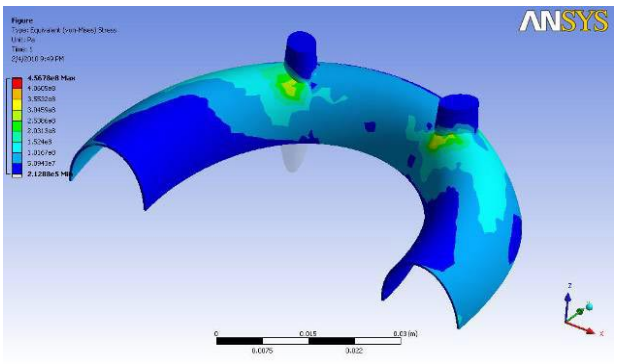

Fig. 2: Stress distribution in the removable framework.

DISCUSSION & CONCLUSIONS: Within the limitation of this study, the effect of the preparation angle is not important for the stress values in the conical double crowns. The stress values increase with the taper only in the removable partial framework (with 21.13%) for the studied cases. In the inner crowns similar variations were observed (21.01%), but they didn't vary with the taper.

REFERENCES: [1] K. Nagata, H. Takahashi, M. Ona, H. Hosomi, N Wakabayashi, Y.Igarashi (2009) *Dent Mater J* 28(5):649-56. [2] M.A. Gungor, C. Artunc, M. Sonugelen, M. Toparli (2002) *J Oral Rehabil* 29(11):1069-75. [3] B. Wostmann, M. Balkenhol, A. Weber, P. Ferger, P. Rehmann (2007) *J Dent* 35(12):939-45. [4] I. Stancic, A. Jelenkovic (2008) *Gerodontology* 25(3):162-7.

ACKNOWLEDGEMENTS: This study was supported by the Grant ID_1264 from the Ministry of Education and Research, Romania.