

BIOMECHANICAL RISKS OF TEETH WITH SEPARATED ORIGINAL AND COUNTERFEIT ENDODONTIC INSTRUMENTS LOCALIZED AT DIFFERENT LEVELS WITHIN ROOT CANAL

Objectives. To evaluate if counterfeit origin of separated endodontic instruments influence biomechanical prognosis of tooth.

Materials and methods. Approximated single rooted mandibular premolar model was formulated for the finite element analysis (FEA). Imitation of separated endodontic file localization was provided at two different levels: through the curvature but 3 mm before root apex, and behind the curvature with blocking 3 the most apical mm within the root. Imitated curvature degree was 60°, while two different radius of curvature were imitated of 5 mm and 2 mm. Broken endodontic fragment of 3 mm in length and apical part of size 20 and taper 0.04 were imitated in the study. SEM analysis of counterfeit endodontic files revealed that they are characterized with deviant cross-section, specific angle of flutes and not ISO-standardized design of the apical part. All these aspects were considered while modeling original and counterfeit endodontic files within the root canal for further FEA. Stress distribution and stress concentration zones were studied while imitating of 350 N vertical load.

Results. Teeth with imitated broken counterfeit endodontic files separated in the projection through the curvature were characterized with the highest peaks of stress concentrations at the contacts of broken fragment with surrounded dentine compare to other imitated scenarios; nevertheless such level of local uneven stress distribution seems not to be clinically critical considering other zones of stress concentrations unrelated with broken instrument. Stress concentrations were higher at the projection of curvatures with the smaller diameter in cases when separated instruments were located right at the curvature ($p < 0.05$).

Conclusions. Provided FEA analysis revealed that teeth with separated original and counterfeit endodontic instruments characterized with analogical biomechanical risks if compared clinical scenarios of broken file localization are identical, and those risks could not be interpreted as clinically significant.

Keywords: endodontics, root canal therapy, biomechanical phenomena, bite force