

Abstract:

*Introduction:*

One of the key prerequisites of high-quality endodontic treatment is the use of endodontic NiTi instruments for the preparation of root canals. The purpose of this dissertation is to evaluate the effect of individual factors which influence the life of endodontic instruments during the clinical treatment of root canals. The dissertation will evaluate the effect the curvature of the canals, the shape of the tip of the instrument, the speed and type of rotation, and the influence of sterilization. The effect of low-temperature plasma nitriding on the fatigue life of the instruments will also be investigated.

*Materials and methods:*

Several endodontic systems used for the machine preparation of root canals were studied. The study focused predominantly on the cyclic fatigue of rotary endodontic instruments, wherein the files were rotated in artificial curved root canals. Additionally, the influence of sterilization on the life of the instruments was also examined. Finally, the instruments were treated using thermal plasma nitridation for the purpose of improving their properties. The instruments were then analyzed using a scanning electron microscope and a microhardness meter.

*Results:*

Testing cyclic fatigue in artificial root canals with radii R3 and R5 revealed that instruments with a higher hardness (square profile, triangular profile) are suited for use in preparing straight or slightly curved root canals. For strongly curved root canals, the use of less hard instruments (S shape) is suitable. The results of the experiment also confirmed that the process of low-temperature plasma nitriding is capable of creating a nitride layer on nickel titanium instruments. Tests of cyclic fatigue showed that the process of plasma nitriding is capable of increasing the cyclic fatigue life of instruments.

*Conclusion:*

Currently, there exists no endodontic instrument capable of fulfilling all requirements for the ideal preparation of root canals. New materials should be produced and studies conducted in the continuing search for a system which could combine effectiveness and safety in endodontic instrumentation.