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Dentin Infractions after Different Root Canal Preparation Methods

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Objectives:

Endodontic shaping procedures are needed to clean and disinfect the root canal system by rinsing. The risk of dentinal defects depends from instrument type and motion. Infractions of root dentin enhance the risk of tooth fractures and, therefore, should be avoided. However, the trend in endodontics to reduce the instrumentation sequences is potentially increasing the dentin infraction risk. It was, therefore, the aim of this study to compare the incidence of infractions after endodontic canal instrumentation with four current file systems.

Material and Methods:

Human first maxillary molars were observed to exclude any traumatic defects, age-matched by assessing the root translucency and randomly divided into four test groups and the control group (n=20 each).

Microscopy of all roots excluded external infractions. Mesio-buccal root canals were instrumented to full working length with nearly similar canal shape and similar apical diameter with Twisted Files (TF, taper .06, ISO 25), TwistedFiles-Adaptive (TF-A, taper .06, ISO 25) (SybronEndo, Orange, USA), ProTaperNext (PTN X2: variable taper .06/ ISO 25) and ProTaperUniversal (PTU F2: variable taper .08, ISO 25) (Dentsply-Maillefer, Ballaigues, Switzerland). The control group remained uninstrumented. The tooth roots were horizontally sectioned at 3, 6 and 9 mm from the apex and microscopically assessed for infraction presence. The control group (n=20) excluded any internal dentin infraction due to extraction of the teeth. The experimental groups were statistically analyzed (Fisher-Yates-test).

Results:

The morphological features of dentin cracks showed complete and incomplete infractions in different directions. There was no one preferred infraction line although all mesio-buccal roots were anatomically comparable.

All test groups demonstrated infractions: PTN (n=2), TF (n=3), TF-A (n=7) and PTU (n=8). The low risk groups (TF, PTN) were not significantly different to the control group, whereas the high risk groups were significantly different (TF-A: p=0.004, PTU: p=0.002).

Conclusions:

Reciprocating motions of endodontic shaping instruments increase the risk of root infractions.

The ProTaperNext excentric motion and the Twisted File shaping action are *in vitro* less traumatic and may clinically reduce the endodontic infraction risk.

Instrumentation sequence

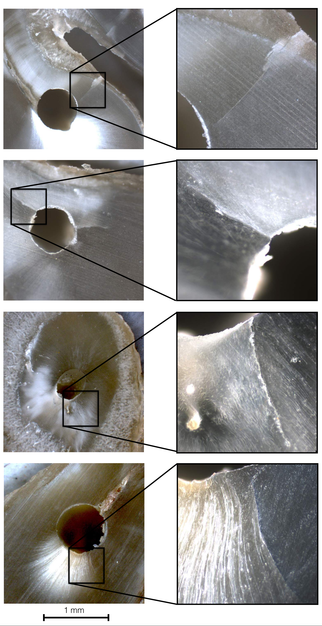
Twisted Files (**TF** 25/.06)

Protaper Universal (**PTU** - S1, S2, F1,

Protaper NEXT (**PTN**, X1, X2)

Twisted Files Adaptive (**TF-A**, SM2 25/.06)

* File cross-section



Dentin infraction in **TF** group at 6mm

Dentin infraction in **TF-A** group at 6mm

Dentin infraction in **PTN** group at 3mm

Dentin infraction in **PTU** group at 6mm

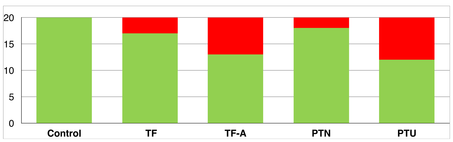


Figure: Number of observed infraction defects (red) in the different groups (n=20), no infractions (green).

P (p-value)	Control	TF	TF-A	PTN	PTU
TF	0.115				
TF-A	**0.004**	0.208			
PTN	0.244	0.658	0.108		
PTU	**0.002**	0.124	0.486	0.056	

Table: Explanation: Number of observations: n=20. P: Test statistics Fisher-Yates-test; p-value, one-sided-test.; bivariate tests two-sided-test. **Bold value:** the null hypothesis of equal distribution of infraction can be rejected at a significance level of less than 5 percent (p<0.05).