

In Vitro Comparison of Fracture Resistance of Endodontically Treated Tooth after
Mechanical Instrumentation with Different Master Apical File Size

Tanompetsanga P, Tungawat P, Bojarus A, Piyarat S, Bounpirom P, Sutthinaksombat P, Ngamyong T, Sirikulkobdach D, Jadsadakraisorn C.

Faculty of Dental Medicine, Rangsit University, Pathumthani, Thailand.

Introduction: Mechanical instrumentation method through canal preparation by increasing the size of apical part of the root canal in combination with chemical cleaning have been shown to effectively reduce numbers of bacteria and infected dentin (1,2). However, maintaining the tooth root strength and conservation of the tooth structure is the most important concern during the mechanical instrumentation (3).

Objective: This in-vitro study was performed to evaluate the fracture resistance of the tooth roots after canal preparation using different sizes of master apical files (MAF).

Methodology: 80 extracted single-rooted human premolar teeth were sectioned beyond the cemento-enamel junction (CEJ) to obtain root length of 12 mm. The tooth roots were randomly divided into 5 groups. They were instrumented by using different MAF size of Mtwo rotary NiTi instruments. 10 roots were used as negative control while 10 roots in as a positive control were instrumented to size 50/.04 but not obturated. 60 roots in 3 experimental groups were instrumented by using Mtwo rotary files (VDW GmbH, Germany) to MAF size 30/.05, 40/.06, and 50/.04, respectively. Vertical compaction technique were performed in experimental groups. After 48 hours, the specimens were subjected to fracture testing under universal testing machine (Instron, Canton, MA, USA) at a crosshead speed of 1.0 mm/minute until the root were fractured. Fracture resistance and diameter of the coronal part of the prepared root canals were analyzed by ANOVA and Dunnett T3.

Result: The negative control group showed highest mean fracture resistance and positive control group showed the least fracture resistance . The mean force of fracture values recorded were 1133.20

N, 456.97 N, 922.47 N, 770.95 N, and 619.95 N respectively. There was a significant difference ($p < 0.05$) between groups. Moreover, the result shows that although MAF may be different, the diameter of the coronal part of root canal are not difference ($p < 0.05$)

Table 1 The mean force of fracture, SDs, minimum and maximum values for each group (in Newtons)

Group	Sample size	Fracture resistance(N)	SDs	Min	Max
Negative control	10	1133.20	117.63484	1009.00	1377.00
Positive control	10	456.97	39.38494	389.80	502.10
Group 1	20	922.47	38.11402	892.00	1009.20
Group 2	20	770.95	26.03076	732.30	812.00
Group 3	20	619.95	35.53838	567.10	668.60

Table 2 The mean of Internal and external diameter (in mm.)

Group	Sample size	Internal diameter		External diameter	
		X	Y	X	Y
Negative control	10	0.58	2.43	5.16	7.42
Positive control	10	0.76	2.46	4.59	7.47
Group 1	20	0.79	2.44	4.59	7.51
Group 2	20	0.82	2.42	4.29	7.34
Group 3	20	0.81	2.45	4.57	7.08

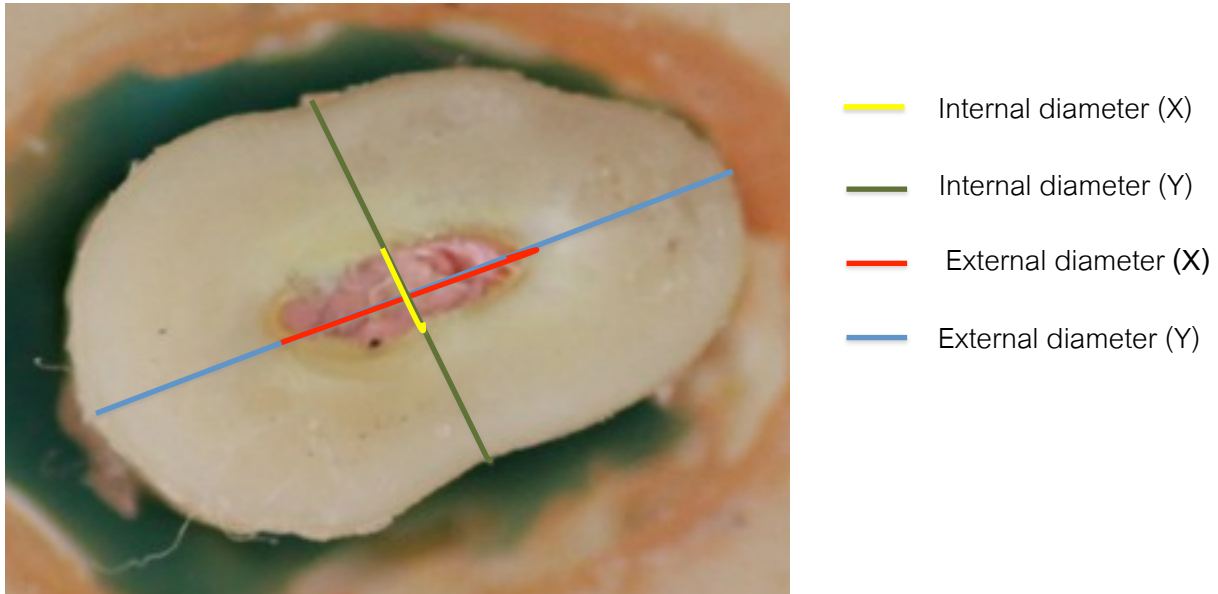


Figure : Showed internal and external diameter of the specimens

Discussion: Our result shows that the fracture resistance was highest in the negative control group and lowest in the positive control group. However, statistically difference of fracture resistance between each experimental group of our data does not correlate with previous study (4). This may be caused by difference method used in the study, such as the type of rotary files, the method used to apply force to the teeth and the presence of remaining periodontal ligament attached to the root during the experiment. Our in vitro study try to simulate the natural supporting structures by still keeping the PDL attached to the tooth root. Our results also show that different MAF size did not affect the size of coronal part of root canal after preparation. Therefore, it can be concluded that MAF size only at the apical third region of the root has an effect on fracture resistance. Based on the results from this study, increased apical enlargement of MAF can weaken mandibular premolar root strength and may even increase the risk of fracture.

Conservation of the tooth structure must be considered during mechanical instrumentation in order to maintain the strength of the root. Further investigations on the other types of teeth may give

further details on the fracture resistance and susceptibility to vertical root fracture during root canal obturation by difference MI methods.

Conclusions: Greater apical enlargement can increase fracture susceptibility of tooth roots .Therefore, during MI, conservation of the tooth structure must be considered in order to maintain the strength of the tooth root.

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