

International Journal of Dental Science and Innovative Research (IJDSIR) **IJDSIR** : Dental Publication Service Available Online at: www.ijdsir.com Volume – 6, Issue – 2, April - 2023, Page No. : 89 – 94 A Comparative evaluation of three reciprocating file systems to assess changes in working length and amount of canal enlargement during root canal instrumentation. ¹G Nithesh Kumar Reddy, Department of Conservative Dentistry and Endodontics, Malla Reddy Institute of Dental Sciences, Suraram, Hyderabad – 500055 ²K Anusha Reddy, Department of Conservative Dentistry and Endodontics, Malla Reddy Institute of Dental Sciences, Suraram, Hyderabad – 500055 ³Chikine Yashas Chandhar, Department of Conservative Dentistry and Endodontics, Government Dental College & Hospital, Afzalgunj, Hyderabad - 500012 ⁴R Preethi, Department of Conservative Dentistry and Endodontics, Malla Reddy Institute of Dental Sciences, Suraram, Hyderabad - 500055 ⁵B Vasavi Sunanda, Department of Conservative Dentistry and Endodontics, Malla Reddy Institute of Dental Sciences, Suraram, Hyderabad – 500055 Corresponding Author: G Nithesh Kumar Reddy, Department of Conservative Dentistry and Endodontics, Post Graduate Resident, Malla Reddy Institute of Dental Sciences, Hyderabad, India. Citation of this Article: G Nithesh Kumar Reddy, K Anusha Reddy, Chikine Yashas Chandhar, R Preethi, B Vasavi Sunanda, "A Comparative evaluation of three reciprocating file systems to assess changes in working length and amount of canal enlargement during root canal instrumentation", IJDSIR- April - 2023, Volume - 6, Issue - 2, P. No. 89 - 94. **Copyright:** © 2023, G Nithesh Kumar Reddy, et al. This is an open access journal and article distributed under the terms of the creative common's attribution non-commercial License. Which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms. Type of Publication: Original Research Article **Conflicts of Interest: Nil** Abstract ONE RECI (MICRO MEGA) AND JIZAI (MANI) up to

Aim of this study is to compare reduction in working length and area of canal enlargement resulting from instrumentation with JIZAI (MANI), ONE RECI (MICRO MEGA), WAVE ONE GOLD(Dentsply) files. **Method:** A total of 45 plastic canal models (n=15) were used, with a canal curvature of <30°. Instrumentation of each group was performed using each of the file systems Instrumentation of each group was performed using each of the file systems WAVE ONE GOLD (DENTSPLY), size 25. Working length measurements was taken before and after instrumentation with each file type. Composite images were created by superimposing pre- and postpreparation photographs, and the difference in area was calculated using ImageJ software.

Statistical analysis: The data was statistically analyzed using One way ANOVA and Multiple Comparison Tukey's post hoc test.

Result: There was no statistically significant difference between Jizai and One Reci but Wave one gold showed decrease in working length and greater canal enlargement.

Conclusion: A significant change in working length and amount of canal enlargement was observed in WAVE ONE GOLD (DENTSPLY) than compared to ONE RECI (MICRO MEGA) AND JIZAI (MANI).

Keywords: Canal Enlargement, Jizai, One Reci, Reciprocation, Working Length, Wave One Gold. **Introduction**

In order to prepare the intraradicular space for 3dimensional filling, chemo mechanical preparation is performed. The typical canal form has a constantly tapering conical shape, with the canal orifice and the apical foramen at its widest and narrowest points respectively.^[1] In order to achieve this, an accurate measure of the root canal working length, which is the distance from a coronal reference point to the apical constriction, is essential. There is general agreement that maintaining instrumentation and root filling within the root canal is desired.

The apical position of the root filling with respect to the radiographic apex is a significant variable in determining the outcome after root canal treatment.^[2-3] When the root canal filling is placed within 2 mm of the radiographic apex (94%) compared to root canal fillings placed more than 2 mm short of the radiographic apex (68%) and those extruded beyond the radiographic apex (76%), a favorable outcome for teeth affected by apical periodontitis is most predictably achieved.^[2]

Despite efforts to maintain a consistent working length, numerous studies have shown that a reduction in the working length commonly occurs during root canal instrumentation, this result in an unpredictable depth of canal preparation during treatment. When working length is reduced, over instrumentation and overfilling are likely to occur, which may result in clinical symptoms of delayed periapical healing or a foreign body reaction.^[4-16] The reduction in the working length is most pronounced in curved canals and has been attributed to the tendency of files to straighten in the canal and thus remove excessive amounts of dentin from the inner wall in the midroot area and from the outer wall in the apical part of the canal.^[6-12] Although the degree of canal curvature is a factor outside the clinician's control, another significant variable affecting working length reduction is the type of endodontic file system used during instrumentation.

Various studies have shown that the preparation of curved root canals with stainless steel instruments frequently results in undesirable aberrations such as elbows, zips, and danger zones. Ni-Ti endodontic instruments were introduced to facilitate instrumentation of curved canals. Ni-Ti instruments are super elastic and could flex far more than stainless steel instruments before exceeding their elastic limits. Ni-Ti alloys have been found to be 2-3 times more elastic than similarly manufactured stainless steel files. This property may allow Ni-Ti files to negotiate curved canals with less lateral stress. Several studies have confirmed that rotary Ni-Ti files maintain the original canal curvature better than stainless steel files. The stainless-steel files produce a larger extent of movement because of their hardness, which was shown to be 3-4 times harder than Ni-Ti alloys. Engine-driven Ni-Ti instruments can be either rotary or reciprocating.^[9-22] Recently two reciprocating files have been introduced namely ONE RECI (MICRO MEGA) AND JIZAI (MANI).

The main purpose of this study was to compare and analyze the change in working length and canal enlargement using wave one gold, Jizai and One Reci

files. The null hypothesis is that there is no distinct difference in change in the working length and canal area enlargement.

Materials And Methods

Forty-five plastic canal models (Nissin Dental Products, Kyoto, Japan) with mean canal curvature of 30° were divided into three groups (n=15).

The canal working length was determined using a size 15 k file and measured the distance from superior border of the canal to the apical constriction of the resin blocks. All canals were prepared to this working length up to a size 25 file, according to a sequence specific to the endodontic file system.

A particular glide path was ensured using standardized K-files sizes 10 and 15.

- WAVE ONE GOLD: files size of 15/2 and 025/07 were connected to the econnect (orikam) at setting of 150⁰/30⁰.
- **JIZAI:** files size of 17/4 and 025/06 were connected to the econnect (orikam) at setting of 150⁰/30⁰.
- ONE RECI: files size of 15/3 (300 rpm, 1.2 N.cm), 025/06 (170⁰/60⁰).

To avoid bias instrumentation was done by a single operator. Irrigation with distilled water was performed repeatedly after every instrument usage, and the files were cleaned regularly on a sponge to remove resin debris. After instrumentation, the canal was dried, and working length measurements were recorded using a size 15 k file.

Images of plastic canals before and after instrumentation were taken using a Canon (Tokyo, Japan) camera with a Canon EF 100mm f/2.8L IS USM Macro Lens. Red dye was added to the canals after instrumentation to improve visibility. The same position was maintained for each photograph. The canal area before and after instrumentation was calculated using ImageJ software (National Institutes of Health, Bethesda, MD) and the percentage change in canal area calculated. Fifteen composite images were created for each group from superimposed pre-instrumentation and post instrumentation images.

The data was statistically analyzed using SPSS version 22(IBM Corporation, Armonk, New York, USA). P < 0.05 was considered statistically significant. The significance of the file type on change in the working length and canal area was assessed using the One-way ANOVA (p<0.05). Multiple Comparison Tukey's post hoc test was conducted for comparison between file systems(p<0.05).

Results

Effect of File Type on Change in Working Length

Wave one gold showed greater change in working length than Jizai and One Reci. When pairwise test was performed there was a significant difference between Wave one gold and Jizai, Wave one gold and One Reci. With no statistical significance between Jizai and One Reci. (Table 1, 2 Graph 1)

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Groups	N	Mean	Standard Deviation	95% confiden interval for me		P value
				Lower Bound	Upper Bound	
Wave one gold	15	0.472	0.12	0.320	0.62	0.002*
JIZAI	15	0.240	.066	0.15	0.32	1
ONE RECI	15	0.248	.069	0.16	0.33	

One Way ANOVA; p<0.05 considered statistically significant

Table 2: Multiple Comparison pairwise between various groups using post hoc analysis- Tukey's test

Between Comparison	Mean Difference	P value
Wave one gold v/s Jizaj	-0.232	0.004*
Wave one gold v/s One Reci	-0.224	0.005*
Jizai v/s One Reci	0.008	0.989

p<0.05 considered statistically significant

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Effect of File Type on Change in Canal Area

Wave one gold showed greater change in canal area than Jizai and One Reci. When pairwise test was performed there was a significant difference between Wave one gold and Jizai, Wave one gold and One Reci. With no statistical significance between Jizai and One Reci. (Table 3, 4 Graph 2)

Table 3: change in canal enlargement

Groups	N	Mean	Standard Deviation	95% confidence interval for mean		P value
				Lower Bound	Upper Bound	
Wave one gold	15	10.16	1.10	8.79	11.53	0.000*
JIZAI	15	5.41	1.33	3.75	7.06	1
ONE RECI	15	5.36	1.46	3.54	7.17	

One Way ANOVA; p<0.05 considered statistically significant

Table 4: Multiple Comparison pairwise between various groups using post hoc analysis- Tukey's test

Between Comparison	Mean Difference	P value
Wave one gold v/s Jizaj	4.756	0.000*
Wave one gold v/s One Reci	4.806	0.000*
Jizai v/s One Reci	0.050	0.998

p<0.05 considered statistically significant

Graph 2: Change in Canal Enlargement



Discussion

To standardize the canal anatomy for every group plastic canal model (Nissin Dental Products, Kyoto, Japan) with mean canal curvature of 30° were used in the present study.

The results of this study indicate that a reduction in working length and canal area enlargement consistently occurs during instrumentation. So, the null hypothesis was rejected as there is significant difference in change in working length and canal area enlargement. When WAVE ONE GOLD(DENTSPLY) and JIZAI (MANI), WAVE ONE GOLD(DENTSPLY) and ONE RECI (MICRO MEGA), were compared WAVE ONE GOLD (DENTSPLY) showed more decrease in working length. This indicates that the type of endodontic file system is a significant factor in determining the working length reduction produced during instrumentation. Change in working length was present in all the groups.

Greater canal enlargement was present in Wave One Gold. This may be due to the reason of greater taper of WAVE ONE GOLD (DENTSPLY) which is 7% whereas for ONE RECI (MICROMEGA) and JIZAI (MANI) taper is 6%.

These findings are consistent with study done by M Remya et al and they concluded that WAVE ONE GOLD(DENTSPLY) lacked the canal centering ability which results in unequal removal of root dentin during

instrumentation. This may be due to variable-taper and file cross-section changes from the apical part with a modified triangular convex and neutral rake angle which may be attributed to the lower centering ratio.^[23]

Pérez et al compared Shaping Ability of 6 Nickel-Titanium File using Micro-computed Tomography in which TRUSHAPE and WAVE ONE GOLD(DENTSPLY) touched the highest percentages of canal surfaces (81% and 73%, respectively) but produced the biggest changes in the canal anatomy.^[24]

Burklein S et al compared Shaping Ability and Debris Extrusion of Rotary Nickel-Titanium Root Canal Instruments (Jizai and wave one gold) and concluded that JIZAI (MANI) resulted in significantly less canal straightening than wave one gold instruments.^[25] Jizai has a unique asymmetrical cross-sectional design , resulting in an offset mass of rotation. The crosssectional shape is characterized by radial lands at the shorter side of a modified rectangle. The impact of the cross-sectional shape of NiTi instruments on clinically relevant properties (such as bending properties and shaping ability) has often been proven previously.

Limitations

- Plastic models were used in the study which cannot simulate natural tooth anatomy.
- Orifice enlargement was not considered as these plastic models have a pre enlarged orifice.
- Only distilled water was used as an irrigant. Type of irrigant also affect the shaping ability of a rotary file.
- Models were analyzed using image j software but not by CBCT or Micro-CT.

Conclusion

In conclusion, this study indicates that jizai and onereci produced the least mean reduction in working and smallest increase in canal size. A significant change in

working length and amount of canal enlargement was observed in wave one gold.

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