Journal of Dentomaxillofacial Radiology, Pathology and Surgery

Winter 2018, Volume 7, Number 4

Research Paper: The Compaction Index of Root Canal Obturation With Different Gutta-Percha Tapers and Finger Spreaders

Elnaz Mousavi[1], Alireza Nosrati[2], Niloufar Falah[2], Maryam Nazifi[2]

1. Assistant of Professor, Dapartment of Endodontics, School of Dentistry, Guilan University of Medical Sciences, Rasht, Iran.
2. Dentistry Student, Student Research Committee, School of Dentistry, Guilan University of Medical Sciences, Rasht, Iran.

Use your device to scan and read the article online

Citation: Mousavi E, Nosrati A, Falah N, Nazifi M. The Compaction Index of Root Canal Obturation With Different Gutta-Percha Tapers and Finger Spreaders. Journal of Dentomaxillofacial Radiology, Pathology and Surgery. 2018; 7(4):163-166. http://dx.doi.org/10.32598/3dj.7.4.163

http://dx.doi.org/10.32598/3dj.7.4.163

Article info:
Received: 19 July 2018
Accepted: 25 Oct 2018
Available Online: 01 Dec 2018

Keywords:
Gutta-Percha, Stainless Steel, Titanium nickelide, Nickel Titanium, Root canal obturation

ABSTRACT

Introduction: The most prevalent approach for the obturation of roots, which are treated endodontically, is lateral condensation. Finger spreaders insignificantly affect packing the gutta-percha cones. This survey aimed to compare the compaction index of root canal obturation obtained with Stainless Steel (SS) and Nickel-Titanium (Ni-Ti) spreaders and different gutta-percha tapers.

Materials and Methods: Forty extracted maxillary central incisors were randomly divided into 4 groups of 10 teeth. In group 1, the canals were filled with 0.02 tapered gutta-percha and SS spreader; group 2 with 0.02 tapered gutta-percha and Ni-Ti spreader; group 3, with 0.04 tapered gutta-percha and SS spreader, and group 4 with 0.04 tapered gutta-percha and Ni-Ti spreader. The compaction index was compared among the different groups using the Independent Samples t-test.

Results: The mean compaction index for the groups that were filled with 0.02 tapered gutta-percha cones was 1.44 with the use of SS spreaders and 1.18 with the use of Ni-Ti spreader; however, the difference was not statistically significant. Furthermore, the mean compaction index for the groups that were obturated with 0.04 tapered gutta-percha cones was 1.561 with the use of SS spreaders and 1.269 with the use of Ni-Ti spreaders. Similarly, this difference was not statistically significant.

Conclusion: The obturation compaction index was higher when using SS spreaders and 0.04 tapered gutta-percha cones; however, the differences were not statistically significant.

*** Corresponding Author:**
Maryam Nazifi, Dentistry Student.
Address: *Student Research Committee, School of Dentistry, Guilan University of Medical Sciences, Rasht, Iran.*
Tel: *+98 (938) 4704774*
E-mail: *maryam.nazifi1996@gmail.com*

Journal of Dentomaxillofacial Radiology, Pathology and Surgery

1. Introduction

Accomplishing successful Root Canal Treatment (RCT) requires complete debridement, sterilization, and the obturation of the root canal system [1]. The quality of apical obturation significantly affects the success rate of RCT. This occurs through its impact on the leakage prevention of microorganisms and their products into the periradicular tissues [2]. Various techniques exist for root canal obturation, with the lateral condensation method being the most popular [1].

Selecting a suitable spreader is a prerequisite for obtaining proper obturation in the lateral condensation technique [3]. It is recommended that the spreader size and taper be appropriate for penetration into the empty canal to within 1mm, where the apex becomes possible [4]. Finger spreaders are usually more desirable owing to better tactile sensation, apical seal, and control over the apparatus, as well as less pressure applied to the dentin in the filling procedure [3]. There are two types of finger spreaders; Nickel-Titanium (Ni-Ti) and Stainless Steel (SS) [3]. Ni-Ti spreaders are more flexible; therefore, they apply less destroying force to the root than SS spreaders. Moreover, penetration depth is greater with Ni-Ti spreaders [3]. Schmidt et al. argued that Ni-Ti spreaders penetrate the root canals easier than SS spreaders with the same force [3].

Despite the variety of substances used for filling the root canals, gutta-percha is the most commonly applied material for this purpose [3]. The 0.02 tapered gutta-percha master cones are frequently used in the lateral condensation method [5]; however, with the introduction of 0.04 tapered Ni-Ti files, the 0.04 tapered gutta-percha master cones have been developed to match the canal shape created by these files [2]. Most studies have evaluated the effects of spreader size and tapering on gutta-percha condensation quality [6-9]; however, only limited investigations have been performed on the influence of gutta-percha tapering [2]. Therefore, the present study aimed to determine the effects of both gutta-percha tapering and spreader type on the quality of obturation and compaction index of the root canals.

2. Materials and Methods

Forty human extracted maxillary central incisors with completely formed apical foramina and straight roots were used in this experimental study. The crowns were removed by a carbide bur to precisely measure the working lengths. All samples were weighed by a laboratory digital scale (I and D 320A, China) with 0.0001 gr precision; the obtained values were considered as W1. The Working Length (WL) of all canals was measured using a #10 K file where 0.5mm was subtracted from the length through which the file tip was observed at the root's end. The canals were prepared by crown-down technique using m3 pro gold (United dental, China) rotary files and COXOC-Smart1 rotary engine according to the manufacturer's instructions up to #30 file with 0.06 tapering. Between each file number replacement, the canal was irrigated with 10cc of sodium hypochlorite 5.25% solution (Chloraxid, Iran).

After preparing and shaping, the canals were dried entirely by 6% tapered #30 paper cones (Meta Biomed, Korea). After 24 hours, the whole teeth were weighed again, and these values were coded as W2. Concerning the obturation characteristics, the samples were randomly divided into 4 groups of 10 teeth, as follows: Group 1: #30 SS finger spreader (MANI, Japan), #30 master cone with 0.02 tapering:

group 2: #30 Ni-Ti finger spreader (MANI, Japan), #30 master cone with 0.02 tapering;

group 3: #30 SS finger spreader (MANI, Japan), #30 master cone with 0.04 tapering, and

group 4: #30 Ni-Ti finger spreader (MANI, Japan), #30 master cone with 0.04 tapering.

All canals were obturated by the lateral condensation technique. For this purpose, initially, the master cone was inserted within the canal up to the working length. Next, #25 accessory cones were added with the same tapering as the master cone. To equalize the situation, we used the same number of accessory cones in each canal (it is usually one number lower than the master cone). Complete obturation was considered as the inability of the spreader to penetrate more than 4mm of the canal length. In addition, no sealer material was used during the obturation of canals to prevent any additional influence on the teeth weights.

Through the obturation completion, all teeth were weighed once more (W3). Then, the compaction index of each canal was calculated using the Formula 1.

1.

$$\frac{W3-W2}{W1-W2}$$

The mean weight of gutta-percha in each group was determined. The obtained data were analyzed using Independent Samples t-test in SPSS.

3. Results

The study results indicated that the final weights (W3) of the 4 groups were different; however, this difference was not statistically significant (P=0.8353). Table 1 lists the mean W3 values for each teeth group.

Furthermore, the obtained results suggested no significant difference between the mean obturation compaction index in groups 1 to 4. Table 2 presents the mean values for the compaction index in the 4 groups.

According to Table 2, using gutta-percha cones with either 0.02 tapering (groups 1 and 2) or 0.04 tapering (groups 3 and 4) with SS spreaders is more efficient, compared to Ni-Ti spreaders; however, the differences are not statistically significant (P>0.05). Additionally, using gutta-percha cones with greater amounts of tapering results in higher values of obturation compaction index in each spreader, although the differences were not statistically significant (P>0.05).

4. Discussion

The current study evaluated the obturation quality with 0.02 and 0.04 tapered gutta-percha using two SS and Ni-Ti spreaders. The obtained results revealed no significant differences in the compaction index of obturation between the two spreader types. Adel et al. who have compared the compaction index of root canal obturation using Ni-Ti or SS spreaders, also approached a similar result [10].

In this investigation, the mean obturation compaction index for groups 1 and 2 indicated no significant difference. Furthermore, comparing the mean obturation compaction indexes in groups 3 and 4 revealed no significant difference. These data are consistent with those of Hasheminia et al. comparing gutta-percha compaction in the canals filled by the lateral condensation technique using SS and Ni-Ti spreaders [11].

The present study also revealed that the mean obturation compaction index in the groups that Ni-Ti spreaders were used was numerically less than the groups in which SS spreaders were used. This is possibly because Ni-Ti spreaders require less force to penetrate a certain depth of the canal, compared to SS spreaders. Berry et al. demonstrated that SS finger spreaders have higher stiffness than Ni-Ti finger spreaders. Accordingly, some practitioners prefer SS spreaders because of this stiffness to achieve more firm compaction forces; however, the less flexibility of SS spreaders fails to allow these spreaders to reach to within 1 to 2 mm of the working length in some curved canals [12]. Sobhi et al. compared the penetration depth of Ni-Ti and SS finger spreaders in curved root canals [13]. Moreover, Schmidt et al. compared the Ni-Ti and SS spreader penetration in curved canals [1]. Both studies concluded that regardless of curvature degree, Ni-Ti spreaders penetrate further into the canal.

Wilson et al. documented that the mean value difference in the spreader penetration depth was 0.71 mm with Ni-Ti

Table 1. Mean final weights of the different study groups

Group*	W3 (gr)
1	0.6754
2	0.7081
3	0.6626
4	0.6886

* 1: SS spreader and 0.02 tapered gutta-percha, 2: Ni-Ti spreader and 0.02 tapered gutta-percha, 3: SS spreader and 0.04 tapered gutta-percha, 4: Ni-Ti spreader and 0.04 tapered gutta-percha

Table 2. The mean obturation compaction index of different study groups

Group*	Mean Obturation Compaction Index
1	1.44
2	1.180
3	1.561
4	1.269

* 1: SS spreader and 0.02 tapered gutta-percha, 2: Ni-Ti spreader and 0.02 tapered gutta-percha, 3: SS spreader and 0.04 tapered gutta-percha, 4: Ni-Ti spreader and 0.04 tapered gutta-percha

and 0.59 mm with SS spreaders when using 0.02 tapered master cones and 1.22 mm with Ni-Ti and 1.17 mm with SS spreaders when using 0.04 tapered master cones [2]. According to them, radiographically acceptable root canal filling exists when applying 0.04 tapered master cones by the lateral condensation technique [2].

On the contrary, Berry et al. reported no significant difference in the straight canals in the penetration depth of SS and Ni-Ti spreaders [12]. Less force is used to condense gutta-percha by Ni-Ti spreaders, and the odds of gutta-percha's quick return to the original state increases; thereby, the possibility of complete penetration of accessory cones into the space made by the spreader, decreases. Akhlaghi et al. demonstrated that in the root canals that Ni-Ti spreaders were used, further penetration of accessory cones was achieved, in comparison to the SS spreaders [14].

5. Conclusion

The present study suggested that greater gutta-percha compaction is obtained with the use of SS spreaders and more tapered cones; however, the differences were not statistically significant.

Ethical Considerations

Compliance with ethical guidelines

There was no ethical considerations to be considered in this research.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-forprofit sectors.

Authors contribution's

The authors declared no conflict of interest.

Conflict of interest

The authors declared no conflict of interest.

References

[1] Schmidt KJ, Walker TL, Johnson JD, Nicoll BK. Comparison of nickel-titanium and stainless-steel spreader penetration and accessory cone fit in curved canals. Journal of Endodontics. 2000; 26(1):42-4. [DOI:10.1097/00004770-200001000-00011] [PMID]

[2] Wilson BL, Baumgartner JC.Comparison of spreader penetration and obturation density during lateral compaction of 0.04 and 0.02 tapered master cones. Journal of Endodontics. 2003; 29(12):828-31. [DOI:10.1097/00004770-200312000-00011] [PMID]

[3] Hugh CL, Walton RE, Facer SR. Evaluation of intracanal sealer distribution with five different obturation techniques. Quintessence International. 2005; 36(9):721-9.

[4] Gound TG, Reihm RJ, Odgaard EC, Makkawy H. Effect of spreader and accessory cone size on density of obturation using conventional or mechanical lateral condensation. Journal of Endodontics. 2001; 27(5):358-61. [DOI:10.1097/00004770-200105000-00013] [PMID]

[5] Saatchi M, Etesami L. [Comparison of apical microleakage in lateral condensation method using 0.02 or 0.04 tapered gutta-percha master cones (Persian)]. Journal of Dental Medicine. 2007; 20(2):108-12.

[6] Gharai SR, Thrope JR, Strother JM, McClanahan SB. Comparison of generated forces and apical microleakage using nickel-titanium and stainless steel finger spreaders in curved canals. Journal of Endodontics. 2005; 31(3):198-200. [DOI:10.1097/01.don.0000137648.77797.ea] [PMID]

[7] Simons J, Ibanez B, Friedman S, Trope M. Leakage after lateral condensation with finger spreaders and D-11-T spreaders. Journal of Endodontics. 1991; 17(3):101-4. [DOI:10.1016/S0099-2399(06)81738-3]

[8] Xia ZM, Peng B, Bian Z, Fan MW. [Comparison of penetration and obturation density using nickel titanium andstainless steel spreaders in curved canals (Chinese)]. Hua xi kou Qiang yi xue za zhi = Huaxi Kouqiang Yixue Zazhi = West China Journal of Stomatology. 2006; 24(5):429-31.

[9] Idrisi SH, Sathe S, Hegde V, Comparison of Spreader Penetration during lateral compaction of 0.02 tapered Gutta-Percha Master Cones with Stainless steel and Nickel Titanium finger spreader. Endodontology. 2014; 26(2):238-43.

[10] Adel M, Motabha I, Samifar M. Comparison of radiographic density and compaction index of root canal obturation using nickel titanium or stainless-steel spreaders. Journal of Qazvin University of Medical Sciences. 2016; 20(3):20-5.

[11] Hashemi Nia SM, Barkatein B, Vaziri S. Comparison of gutta-percha compaction during lateral condensation method using NiTi and SS spreaders. Dentistry Journal of Islamic Community of Dentists. 2012; 24(1):69-75.

[12] Berry KA, Loushine RJ, Primack PD, Runyan RA, Nickel-titanium versus stainless-steel finger spreaders in curved canals. Journal of Endodontics. 2007; 24(11):752-4 [DOI:10.1016/S0099-2399(98)80167-2]

[13] Sobhi MB, Khan I. Penetration depth of nickel titanium and stainless steel finger spreaders in curved root canals. Journal of the College of Physicians and Surgeons-Pakista. 2003; 13(2):70-2.

[14] Akhlaghi NM, Roghanizad N, Khalilak Z, Rezaie N. Comparison of first accessory cone penetration after using stainless-steel and Ni-Ti spreaders in curved resin blocks. Iranian Endodontic Journal. 2008; 2(4):131-4.