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An in vitro study to compare the efficacy of 2 different rotary instruments for GP removal using 2 different sealers

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***Abstract*---**Background: Failure of endodontic treatment may necessitate retreatment by removing gutta percha from root canals. The present study evaluated the efficiency of retreating gutta-percha obturated root canalas with protaper universal retreatment files, NRT GPR retreatment files while using the sealers, AH plus and Endofill for obturation. Materials and Methods: 80 maxillary premolars were decoronated to obtain a standardized root length of 15 mm. Canals were obturated using thermoplasticized gutta percha (GP) with either AH Plus or Endofill as sealer. Teeth were divided into 4 groups, with 20 teeth in each group, and gutta percha removal was done using (PTUR Protaper universal retreatment), NRT GPR (Nickel titanium

gutta percha remover), for studying their efficiency in terms of total operating time and GP remnants left in the canal. Results: The order of efficiency in terms of time and gutta percha (GP) removal was PTUR > NRT GPR. The difference in GP removal was not statistically significant but the time taken for removal was statistically significant. The use of AH Plus sealer showed more remnants than Endofill sealer and the file system followed the same order of efficiency, but the difference was not statistically significant. Conclusion: Among the various retreatment instruments, the least amount of GP remnants was associated with PTUR followed by NRT GPR.

***Keywords*---**Gutta Percha, Rotary, Retreatment, Sealer.

Introduction

The primary aim of a successful endodontic treatment is to thoroughly debride the canal system of infected or necrotic pulp tissue and microorganisms and to completely seal the canal space, hence preventing the ingress of microorganisms and thereby re-infection of the pulp cavity.[1] The success rate for conventional endodontic treatment, ranges between 53 % - 94%.[2] However, even if 90% of endodontic treatment is successful over time, the reciprocal failure rate is still 10 %. Persistent intraradicular infection occurs most frequently when the original treatment falls short of acceptable technical standards, missed canals, inadequate shaping, cleaning and obturation of the root canal system.[3]

Endodontic retreatment is defined as a procedure performed on a tooth that has received prior attempted definitive treatment resulting in a condition requiring further endodontic treatment to achieve successful results.[4] The treatment options of post treatment disease cases include conventional retreatment, surgical management or extraction.[5] Among these the first line of treatment is non-surgical approach when access to the root canal is feasible. The main objective of nonsurgical retreatment is to remove all material filling from the root canal and to regain access to the apex, which is not ideally clinically achievable.[6]

Many techniques have been described for removing gutta-percha. These include endodontic hand files combined with heat or chemical solvents, engine-driven rotary files, ultrasonic instruments, heat carrying instruments, paper points with chemicals as well as lasers.[7,8] With the advent of rotary NiTi instruments, the time taken for retreatment has come down and this may decrease patient and operator fatigue.[8] The rotary NiTi instruments have been proposed for the removal of filling materials from root canal walls as they provide a more predictable and consistent outcome.

The present study compares the efficiency of retreatment file system NRT GPR (Nickel titanium gutta percha remover) with PTUR (Protaper universal retreatment), in terms of GP removal and time taken for it, while using the sealers Endofill and AH Plus.

Materials and Methods

80 maxillary premolar teeth extracted for orthodontic purposes were used for the study. Teeth with root caries, previous root canal treatment, fractured tooth and tooth with immature apex were not included in the study. Teeth were decoronated with a diamond disk to obtain a standardized root length of 15 mm.. Access opening were made in all specimens. A 10-K file was placed into the canal until it was visible at the apical foramen and the working length was established at 1mm short of that length. Cleaning and shaping was performed using Protaper Universal NiTi rotary instruments.All canals were irrigated with 2.5mL of 5.25% NaOCl. A final flush was performed with 5mL of 17% EDTA for 30 seconds followed by a rinse with 5mL of saline. The specimens were divided into 4 groups of 20 teeth each. Obturation was carried out by thermoplastisized gutta percha obturation technique. Groups 1 and 2 were obturated with gutta-percha and AH Plus and Groups 3 ad 4 were obturated with gutta-percha and Endofill sealer.

Endodontic Retreatment

Group 1 and 3: The retreatment was carried out with Protaper universal retreatment files.The D1 Protaper file was used to remove the filling material from the cervical third of the root canal. A D2 Protaper file was used in the coronal two thirds of the root canal. The D3 Protaper file was used with light apical pulses of pressure until the working length was reached.

Group 2 and 4: The retreatment was carried out with NRT GPR files. Coronal gutta-percha was removed with GG drill, followed by deposition of RC solve for 1 minute. Retreatment was performed using 2S (size 50, 18 mm length, 0.04 taper) and 4N (size 30, 21 mm length, 0.04 taper) instruments against the canal walls in a crown down fashion until working length was reached.

In all the groups retreatment was done until no further filling material could be removed. All the rotary retreatment systems were used in endodontic micromotor (COLTENE) at 300rpm in crown down manner. The time taken for the retreatment procedure was calculated using a stop watch. The total operating time was calculated as the sum of time taken for the initial removal of GP until the working length was reached and for complete GP removal, excluding the time taken for the change of instruments, irrigation and radiographs.

Post treatment radiograph was taken to evaluate the thoroughness of GP removal. The roots were grooved longitudinally in buccolingual direction with a diamond disk and split into two halves with a chisel. The sectioned specimens were observed under Confocal Raman Microscope at 40x magnification and images were captured. The images were transferred to Image J image analyzing software and canal area and amount of debris present were calculated.
The percentage of GP remnants (A) was calculated using the following equation:
A = (area of the remnants X 100) / area of the root canal

Statistical Analysis

For the overall comparison within each of the sealer, ONE WAY ANOVA was used and for the files comparisons in each of the sealer, TUKEY POST HOC method was used. This was done for both the sealers.

Results

1. Maximum amount of GP remnants was associated with AH Plus sealer than Endofill sealer, but the difference was not statistically significant.
2. PTUR remove more remnants as compared to NRT GPR, but the difference was non significant.(Table 2& 3)
3. Total operating time, for GP removal was more with AH Plus sealer than Endofill sealer, and was statistically significant.
4. PTUR took less time for GP removal as compared to NRT GPR and the difference was found to be statistically significant.

Table 1: Intergroup comparison of GP remnants (in %)

S.No.	Group	Mean	Standard Deviation
1.	AH-Plus PTUR	41.10	5.39
2.	AH-Plus NRT GPR	41.12	8.32
3.	Endofill PTUR	37.14	6.41
4.	Endofill NRT GPR	42.27	7.97

Table 2: Intergroup comparison with PTURfiles

Group	N	Mean (%)	SD
AH Plus PTUR	20	41.10	5.39
Endofill PTUR	20	37.14	6.41

Table 3: Intergroup comparison with NRT GPR files

Group	N	Mean (%)	SD
AH Plus NRT GPR	20	41.12	8.32
Endofill NRT GPR	20	42.27	7.97

Discussion

Scientific and technological advances in the field of endodontics have resulted in saving of millions of teeth that would otherwise be lost. There are many instances in which treatments performed at the highest level of clinical excellence resulted in undesirable outcome, and there are other instances in which a procedure is performed well below a scientifically acceptable standard and yet provided long-term success.[2] When encountered with such a situation, the clinician must determine the etiology of the persistent pathosis and devise a rationale strategy for further treatment.[9]

The choice of nonsurgical retreatment versus periapical surgery becomes the focus of the decision in most instances. In general, nonsurgical retreatment will be the preferred choice because it is usually less invasive than surgery and has a less traumatic postoperative course.[6] Retreatment is indicated in circumstances like technical deficiency, procedural errors, pain, swelling or sinus tract, persisting symptomatic tooth or when a new coronal restoration is planned.[10]

In our present study, the obturation was done using thermoplastisized injectable gutta percha technique, as it is proved to be superior in obturation quality than the lateral compaction technique. There are various studies in literature proving the same.[11,12] The difficulty encountered with thermoplastisized technique was the brittleness of the set material. This made it difficult to remove the resultant gutta percha mass from the root canal, and this was consistent with the study of Budd et al in 1991.[13] Different methods have been applied to remove root filling material from canals. These include use of hand files, ultrasonic files, engine-driven instruments, and laser irradiation. This study attempts to compare the effectiveness and efficiency in terms of GP removal and time taken, of a newly introduced retreatment file system, NRT GPR , with PTUR using two different sealers, AH Plus and Endofill.

A new gutta percha remover, NRT GPR manufactured by Mani Inc., Japan was used in this study. The proposed advantages of this system is that it is fracture resistant around the tip part since there is no concentration of stresses due to non-cutting tip. However, an important drawback of these instruments is limited cutting efficacy compared to other retreatment systems available currently.[14] In the present study the better performance of ProTaper Universal retreatment instruments may be due to their specific flute design. The file not only cut gutta-percha but also the superficial layer of dentin during root filling removal. The flute design and rotary motion cut the large amount of gutta-percha in spiral around the instrument and direct it towards the orifices.[15]

Among the rotary retreatment system NRT GPR left behind more remnants as it had a limitation of decreased flexibility, resulting in inability to go around canal curvatures. Current findings showed lesser gutta percha removal efficacy of these instruments along with prolonged treatment time, compared to Protaper instruments.[16] Conventionally, the removal of gutta-percha using hand files with or without solvent can be a tedious, time-consuming process, especially when the root filling material is well condensed. Therefore, the use of rotary NiTi instruments in root canal retreatment may decrease patient and operator fatigue.[17]

In the present study, rotary NiTi instruments were significantly faster in removing gutta-percha, while ProTaper instrument systems required significantly less time for retreatment than and NRT GPR instruments. Thus the total operating time taken for GP removal was in the order PTUR < NRT GPR. In the present study, sealers used for obturation are AH Plus and Endofill sealer. AH Plus has greater adhesion to root dentin than Endofill as it is an epoxy resin based sealer. It has better penetration into the micro-irregularities because of its creep capacity and long setting time, which increases the mechanical interlocking between sealer and root dentin.[18] This justifies the presence of more areas of remnants in samples

obturated with AH Plus than that of the Endofill even though the difference was not statistically significant. Within the limitations of this study, the results showed that NiTi rotary instrument left remnants on the root canal walls. The percentage of remnants left behind was more for NRT GPR followed by PTUR, even though no statistical difference was present. NiTi rotary retreatment files can be used to remove the filling material quickly.

Conclusion

Rotary retreatment systems were more efficient in terms of time and GP removal. Among these techniques, PTUR system was most efficient. However, since all the techniques showed remnants of GP on the canal walls, additional measures such as combination of manual rotary techniques and further instrumentation than the recommended would be beneficial for complete GP removal during endodontic retreatment procedures.

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