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An Update On Gutta-Percha Retrieval Methods

Research Article

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Abstract

Non-surgical endodontic treatment is usually practiced in modern day dentistry. Root canal treatment is the only key treatment for saving your natural teeth. This has given the clinician an opportunity to treat grossly destructed, nonfunctioning teeth to a functional tooth. Although recent advances in surgical, prosthetic and restorative care have made tooth replacement less tedious than in the past, it is unanimously accepted that a natural tooth is a superior choice to extraction and replacement. Root canal treatments are also associated with failures, which necessitate the removal of the obturating material Gutta-percha that were used during the procedure. This review article aims to explain the various non-surgical endodontic methods, which can be used to retrieve Gutta-percha from the root canals.

Keywords: Gutta-Percha; Retrieval; Retreatment; Solvents; Instrumentation.

Introduction

Despite the emergence of new technologies and excellent materials, failures are common in endodontic treatment [1-3]. These are usually identified as radiographic changes in periapical tissues or sometimes as persistent symptoms like pain, swelling indicating the need for reintervention [4, 10]. Persistence of bacterial infection in the root canal and periradicular area before and after the treatment is the principal cause of failure in endodontic treatment [11-19]. So the first therapeutic option in such cases is non-surgical endodontic retreatment [20, 21].

Endodontic retreatment is a procedure to remove root canal obturating materials from the tooth, followed by cleaning, shaping and obturation of the canals [22, 23]. There are many materials which have been advocated for filling root canals [24]. Earlier root canals have been reported to be obturated with Amalgam, Asbestos, Balsam, Bamboo, Gold foil, Lead, Copper, Cement, Oxychloride of zinc, Paraffin [25]. The Obturating materials can be broadly divided based on its basic composition as follows: plastics like Gutta-percha and Resilon, Solids or metal cores like Silver points, Gold, Stainless steel, Titanium and Iridium-platinum. Cements and pastes like Hydro, MTA, Calcium Hydroxide and Gutta flow. According to Grossman, an obturating material should satisfy certain criterias like it should be easy to manipulate with sufficient working time, it should be dimensionally stable, it should not shrink after its insertion into the root canals, Should be able to seal the canal laterally and apically, it should be biocompatible with the periradicular tissues, should be nonporous and impervious to moisture, should be inert, not oxidize or corrode, remain unaffected and should get dissolved by tissue fluids in situations like fractured restoration, should possess some antibacterial properties, should be radiopaque to be detected on radiographs during root canal treatment, Should be sterilizable, Should permit easy removal from root canals in case of Endodontic retreatment or Post space preparation during the restoration of grossly destructed teeth. Gutta-percha is a preferred choice of obturating materials. The name Gutta is derived from two words, GETAH- gum, PERTJA- Name of a tree in Malay language. It is basically an extract of Palaquium, which are natural habitants of SouthEast Asia. It is a trans-isomer of poly isoprene. As its molecular structure is similar to that of natural rubber (cis-isomer of poly iso-

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prene), it has a number of similarities to rubber but a difference in the form makes it to behave more like crystalline polymers. It is composed of Gutta, Alban, Fluanil and also contains traces of tannin, salts and saccharine. This material almost satisfies most of the requirements for an obturating material as given by Grossman. Moreover, it is easy to retrieve this material when compared to other obturation filling materials if there is need of retreatment. There are various methods or techniques for the retrieval of gutta-percha like manual, Rotary, laser etc. The selection of each technique depends on the patient factors, the complexity of the root canal anatomy and ultimately the clinician operative skills and experience.

Gutta-percha can be removed by using:

1. Hand instruments
2. Rotary instruments
3. Ultrasonics
4. Lasers
5. Solvents
6. Microdebriders

Hand Instruments

Hand instruments are mainly used in the apical portion of the canal. Poorly condensed gutta-percha can be easily pulled out by using files.

Hedstrom Files

Hedstrom files are used to engage the cones so they can be pulled out easily. It is possible by inserting the H-file along the side of the loose gutta-percha. The suitable file size is selected and passed along the side of gutta-percha but not engaging to the canal walls. The H-files are rotated quarter-turn clockwise to further ensure engagement with the gutta-percha root canal filling and when the file is withdrawn from the canal, it should pull out of the loose root filling [26]. H-files are particularly effective as the configuration of the file consists of a series of intersecting cones with elevated cutting edges, allowing better engagement of the gutta-percha material.

Gates-Gliddens

Coronal portion of the gutta-percha should always be explored by Gates-Gliddens so as to remove gutta-percha quickly, provide space for solvents, and improve convenience form.

Rotary Instruments

The advent of rotary nickel–titanium (NiTi) files has provided another means of removing single cone or poorly condensed gutta-percha [27]. NiTi files of suitable size are selected so that the cutting flutes will engage the root filling but not to the canal walls. When the rotary NiTi files are activated, the flutes will engage to the gutta-percha and propel the filling out of the canal. The disadvantage of using rotary files in the removal in gutta-percha is the danger of fracture of the files. This may be reduced by applying less apical pressure and keeping the speed and torque in recommended values of the file systems. The recent published studies on the removal of gutta-percha root canal fillings have focused on the use of rotary instruments with or without using organic solvents, comparing their performance with hand instruments. Prasad et al. did a study using Protaper retreatment files D1,D2,D3 (Dentsply) and Mtwo files (VDW, Munich, Germany) for GuttaPercha removal. The teeth were subjected to Cone beam computed tomography analysis and it was concluded that both the instruments retrieved Guttapercha but left some residual sealer material [28]. Another study done by Fatima et al. using 48 single rooted premolars and Protaper retreatment files D1,D2,D3 (Dentsply) and Wave One primary files, concluded that Wave One group required more time in retrieving and resulting in incomplete GP removal [29]. De Mello Junior et al. did a study to evaluate the effect of Microscope and Ultrasonics on GuttaPercha retrieval on forty teeth with straight root canals and found that Ultrasonic use in combination with the microscope resulted in significantly cleaner canals in straight roots [30]. Celik U¨ nal et al. radiographically compared the guttapercha retrieval efficiency of Hand K-files, Hedstrom files and Profile, R-Endo, and ProTaper Universal on 56 molars with curved roots and found that Hand instrumentation left less residual material and was significantly faster than R-Endo and ProFile systems. It was also found that Protaper was associated with more procedural errors (5 fractured instruments and 2 perforations) [31]. Barletta et al., compared Gates glidden, Hand instruments and Reciprocating system, Rotary Protaper system using Computed tomography as an assessing tool on seventy five lower incisors with straight canals and found that there was no significant difference between Rotary and Hand instruments [32]. In contrast to these findings , Giuliani et al. in his study on forty two sectioned teeth with straight canals had proposed that Protaper was better at removing Guttapercha than Hand instruments. According to the studies done by Gu et al.[33], TaSdemir et al.,[34], Barletta et al.,[35], Huang et al .[36] and Saad et al., [37] the rotary instrument were not only more efficient in the removal of Gutta - percha, But also required lesser time than Hand instruments.

Rotary instruments have been recommended for their speed, higher efficiency and safety. The heat generated by rotary instruments also help in softening and displacement of guttapercha from the root canal. Furthermore, Passive ultrasonic irrigation along with rotary instrumentation during retreatment improves the efficiency of the retreatment system and the acoustic streaming produced by the ultrasonic tip, promotes removal of obturation material from the canal walls [38]. The Rotary instruments are also associated with the greater risk of Guttapercha extrusion during the retreatment procedure. So the dentist should take utmost care while performing the retreatment procedure with rotary files.

Ultrasonics

The use of ultrasound in re-treatment is generally confined to hard pastes/cements and sealers such as glass ionomer cements or as final debridement. Ultrasonic files activated without irrigation create frictional heat and can be used to plasticize gutta-percha, hence facilitating its removal. However, the thermoplasticized gutta-percha tends to be forced against the root canal wall, creating considerable debris; furthermore, the ultrasonic files can only be used in the straight part of the canal. The use of ultrasound as a final step as an adjunct to traditional instrumentation for gutta-percha and sealer removal has been investigated; there

was no significant difference in the level of residual debris compared to hand instrumentation alone using chloroform or sodium hypochlorite as an irrigant. Ladley et al. compared ultrasound to hand files for the removal of gutta-percha and reported that ultrasonically energized files were significantly more efficient and were equally effective as hand instrumentation. In this study, the ultrasonic files were used with solvent, which tended to create a "slurry" that coated the root canal walls. In addition, only straight roots were investigated; the use of ultrasonic files in curved roots may lead to procedural errors such as ledges, blockages or perforations. Nevertheless, it was concluded that ultrasonically activated files would be an efficient technique to remove the bulk of the gutta-percha root filling.In a recent ex vivo study, maxillary incisor teeth with straight roots were retreated using Gates-Glidden drills, ultrasonic instruments and a solvent. In half of the samples, the additional use of an operating microscope and ultrasound to complete the canal instrumentation resulted in significantly cleaner canals.

Lasers

The benefits of lasers in endodontic therapy have been demonstrated in studies on root canal instrumentation, bacterial effects, dentin permeability and removal of debris and smear layer. Early development of the fiberoptic systems of Nd:YAG laser, which enables delivery of lasers in narrow root canals, made this laser most widely used in endodontics. A laboratory study investigated the potential application of a Nd:YAP laser in root canal retreatment [39]. For effective material removal, the Nd:YAP laser had to be used in a dry root canal. It was utilized alone or in combination with hand instruments to remove various canal sealers and broken instruments. However, there was concern about the excessive heat generated and the safety parameters so the study was described as preliminary in nature. Thereafter, the attention shifted to the use of the Nd:YAG laser for removal of guttapercha [40, 41] and fractured files [42]. It was found that laser irradiation was capable of softening guttapercha and the addition of solvents did not improve the re-treatment process either in terms of the time required for removal or the amount of gutta-percha remnants. As with other techniques, all of the root filling material could not be predictably removed from the root canal system. Anjo et al., [41] compared a Nd:YAG laser to Gates-Glidden drills and K-files for the removal of root filling materials and reported that the use of a laser resulted in significantly shorter treatment times; it was also noted that several of the dentinal tubules were blocked with melted dentin following treatment. There is widespread concern regarding the heat generated with lasers being transferred to bone and the surrounding tissues. However further research is needed to establish safety parameters for the usage of lasers to remove root filling materials in clinical practice.

Microdebriders

These are small files constructed with 90-degree bends and are used to remove any remaining gutta-percha on the sides of the canal walls or isthmus after the repreparation

Solvents

Gutta-percha is material of choice for root canal obturation, and its retrieval is made easier by the use of organic Gutta-percha solvent [43, 44]. Mechanical removal of Gutta-percha will clear only the bulk of the material but the remnant in the form of debris needs to be removed by organic solvents. These solvents will soften the gutta-percha and will facilitate its easy removal. It is also safe to use solvents, especially when it is used deep inside the canal. The commonly used solvents are Chloroform, Halothane, benzene, Tetrachloroethylene, Xylene, Eucalyptus oil and refined orange oil. Traditionally chloroform was used as a Gutta-percha solvent as it was highly effective in dissolving it. However, it is associated with cytotoxic effects when it comes in contact with periradicular tissues. It also has been classified as a potent carcinogen and can pose a risk to the dental team. However, some manufacturers recommend its use as a solvent. It is because of the proven fact that the judicious use of chloroform as solvent in non-surgical endodontic retreatment will not cause much side effects. So, in an attempt to find a less toxic, more biocompatible solvent, many alternative materials like Xylene or Xylol, Eucalyptol, Methyl chloroform, Tetrahydrofuran, methylene chloride, halothane, rectified turpentine and orange solvent were investigated. It was found that the Xylene was a better choice in terms of less cytotoxic effects but it was reported to be less effective than chloroform in removing the gutta-percha. Eucalyptol is the least effective solvent among all; however, its efficacy can be improved by warming it. Wennberg et al had concluded that methyl chloroform can be used as a best alternative to chloroform as it was effective and less toxic, but its action was much slower than chloroform. Other solvents like orange oil, Halothane, were found to be effective, but their action was slower than that of Chloroform. In general, all the organic solvents will have some cytotoxic effects on periradicular tissues. It depends on the clinician how judiciously they are using it. The organic Gutta-percha solvents will cause no detrimental side effects as long as they are limited within the confines of the root canal.

Conclusion

Endodontic retreatment is more challenging than treating the root canal infections for the first time. If not approached cautiously it could result in serious iatrogenic complications to the extent that the teeth cannot be saved anymore. Most difficult part of Endodontic retreatment is retrieval of Gutta-percha from the root canals. This often can be a time-consuming process. Therefore, it is not sufficient for a clinician to be familiar with the methods, which already exist for retrieval of Gutta-percha but is also important to get updated with newer methods, which have evolved over time.

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