



MANAGEMENT OF LEDGE FORMATION IN ROOT CANAL TREATMENT

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ABSTRACT

Aim - The aim of the review is to assess management of ledge formation in root canal treatment.

Objective-The objective of the review is to assess management of ledge formation in root canal treatment.

Background-Failure to grasp the rationale behind cleaning and shaping concepts can increase the occurrence of needless complications, such as ledges. A ledge is created when the working length can no longer be negotiated and the original pathway of the canal has been lost. Extension of the access cavity to provide unobstructed access to the root canals, precurving and not forcing instruments, using NiTi files, using passive step-back and balanced force techniques, and instrumenting the canal to its full length will all help to prevent ledge formation.

Reason-A review of the literature and a discussion of the options for management of ledge formation are presented

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INTRODUCTION

Endodontic mishaps or procedural accidents are unfortunate occurrences that can occur during treatment. Some might be due to inattention to detail, whereas others are unpredictable (1). Failure to grasp the rationale behind cleaning and shaping concepts can increase the occurrence of needless complications such as blockages, ledge formation, apical transportation, and perforations. These have been attributed to inappropriate cleaning and shaping concepts (2). Among the implications most commonly observed during root canal instrumentation is a deviation from the original canal curvature without communication with the periodontal ligament, resulting in a procedural error termed ledge formation or ledging. This often results when the operator works the files short of the full canal length, and the canal becomes blocked at that “short point”. This might create a ledge, or it might begin to form a new pathway at the true pathway of the root canal (3). The presence of a ledge might exclude the possibility of achieving an adequately shaped canal preparation that reaches the ideal working length, and this can result in incomplete instrumentation and disinfection of the root canal system as well as incomplete filling of the canal. The root canal space apical to the ledge is difficult to thoroughly clean and shape; therefore, ledges frequently result in ongoing periapical pathosis after the endodontic treatment.

Consequently, there might be a causal relationship between ledge formation and unfavorable endodontic treatment outcomes.

Etiology

Ledges might be caused by a number of errors during endodontic treatment, such as: Not extending the access cavity sufficiently to allow adequate access to the apical part of the root canal (4). Complete loss of control of the instrument if the endodontic treatment is attempted via a proximal surface cavity or through a proximal restoration. Incorrect assessment of the root canal direction. Erroneous root canal length determination. Forcing and driving the instrument into the canal using an on curved stainless steel instrument that is too large for a curved canal. Failing to use the instruments in sequential order.

Rotating the file at the working length (that is, overuse of a reaming action). Inadequate irrigation and/or lubrication during instrumentation. Over-relying on chelating agents (5). Attempting to retrieve broken instruments. Removing root filling materials during endodontic retreatment. Attempting to prepare calcified root canals. Inadvertently packing debris in the apical portion of the canal during instrumentation (6)

Recognition

Recognition of a ledge is the first step in its management; this might be by clinical or radiographic observation. When a ledge is formed, the canal is usually “straightened” at that point. Suddenly the file no longer negotiates the curve but catches on a “dead end”. (7) There might be a loss of normal

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tactile sensation of the tip of the instrument binding in the lumen of the canal.(8) This feeling is supplanted by that of the instrument point hitting against a solid wall, that is, a loose feeling with no tactile sensation of tensional binding. When ledge formation is suspected, a radiograph of the tooth with the instrument placed at the point of the suspected ledge should provide additional information. (9) The central x-ray beam should be directed perpendicularly through the involved area. If the radiograph shows that the instrument point is directed away from the lumen of the canal, then it is highly likely that there is a ledge, and the subsequent completion of the root canal preparation must include an effort to bypass this ledge (10). In cases that require endodontic retreatment by removing an existing root canal filling, the possible presence of a ledge should be considered when the existing root canal filling is at least 1 mm shorter than the ideal working length, or if the filling appears to have been placed in a position that is deviated from the natural pathway of the root canal, especially in teeth in which the root canal curves to any significant extent.(11)(12).

Techniques of Cleaning and Shaping

Watch Winding

Watch winding is reciprocating back and forth (clockwise/counterclockwise) rotation of the instrument in an arch. It is used to negotiate canals and to work files to place. Light apical pressure is applied to move the file deeper into the canal.

Reaming

Reaming is defined as the clockwise, cutting rotation of the file. Generally the instruments are placed into the canal until binding is encountered. The instrument is then rotated clockwise 180-360° to plane the walls and enlarge the canal space.

Filing

Filing is defined as placing the file into the canal and pressing it laterally while withdrawing it along the path of insertion to scrape the wall. There is very little rotation on the outward cutting stroke. The scraping or rasping action removes the tissue and cuts superficial dentin from the canal wall. A modification is the turn-pull technique. This involves placing the file to the point of binding, rotating the instrument 90° and pulling the instrument along the canal wall.(13)

Circumferential Filing

Circumferential filing is used for canals that are larger and or not round. The file is placed into the canal and withdrawn in a directional manner sequentially against the mesial, distal, buccal, and lingual walls.

Standardized Preparation

After 1961, instruments were manufactured with a standard formula. Clinicians utilized a preparation technique of sequentially enlarging the canal space with smaller to larger instruments at the corrected working length. In theory this created a standardized preparation of uniform taper. Unfortunately this does not occur. This technique was adequate for preparing the apical portion of canals that were relatively straight and tapered; however in cylindrical and small curved canals procedural errors were identified with the technique.(14)

Step Back Technique

The step-back technique, reduces procedural errors and improves debridement. After coronal flaring and determining the master apical file (initial file that binds slightly at the corrected working length), the succeeding larger files are shortened by 0.5 or 1.0 mm increments from the previous file length. This step-back process creates a flared, tapering preparation while reducing procedural errors. The step-back preparation is superior to standardized serial filing and reaming techniques in debridement and maintaining the canal shape. The step-back filing technique results in more pulpal walls being planed when compared to reaming or filing. (15)

Step Down Technique

The step down technique is advocated for cleaning and shaping procedures as it removes coronal interferences and provides coronal taper. Originally advocated for hand file preparation it has been incorporated into techniques employing nickel-titanium files. With the pulp chamber filled with irrigant or lubricant the canal is explored with a small instrument to assess patency and morphology (curvature). The working length can be established at this time. The coronal one third of the canal is then flared with Gates Glidden drills or rotary files of greater taper (.06, .08, .10,). A large file (such size #70) is then placed in the canal using a watch winding motion until resistance is encountered. The process is repeated with sequentially smaller files until the apical portion of the canal is reached. The working length can be determined if this was not accomplished initially. The apical portion of the canal can now be prepared by enlarging the canal at the corrected working length. Apical taper is accomplished using a step-back technique. (16)

Passive Step Back Technique

The passive step-back technique is a modification of the incremental step-back technique. After the apical diameter of the canal has been determined, the next higher instrument is inserted until it first makes contact (binding point). It is then rotated one half turn and removed. The process is repeated with larger and larger instruments being placed to their binding point. This entire instrument sequence is then repeated. With each sequence the instruments drop deeper into the canal creating a tapered preparation. This technique permits the canal morphology to dictate the preparation shape. The technique does not require arbitrary rigid incremental reductions and forcing files into canals that cannot accommodate the files. Advantages to the technique include: knowledge of canal morphology, removal of debris and minor canal obstructions, and a gradual passive enlargement of the canal in an apical to coronal direction.(17)

Recapitulation

Recapitulation is important regardless of the technique selected. This is accomplished by taking a small file to the corrected working length to loosen accumulated debris and then flushing it with 1-2 ml of irrigant. Recapitulation is performed between each successive enlarging instrument regardless of the cleaning and shaping technique.

Nickel Titanium Rotary Preparation

Nickel titanium rotary preparation utilizes a crown-down approach. The specific technique is based on the instrument

system selected. One instrument sequence uses nickel titanium files with a constant taper and variable ISO tip sizes. With this technique, a .06 taper is selected. Initially a size .06/45 file is used until resistance, followed by the .06/45, .06/40, .06/35, .06/30, .06/25, and .06/20. In a second technique, nickel titanium files with a constant tip diameter are used. The initial file is a .10/20 instrument, the second a .08/20, the third a .06/20, and the fourth a .04/20. For larger canals a sequence of files using ISO standardized tip sizes of 30 or 40 might be selected. Using the crown down approach creates coronal flare and reduces the contact area of the file so torsional forces are reduced. (18)

Prevention

The best approach to managing ledges is prevention. If the operator is careful and attentive during the instrumentation process, then the chance for an impediment such as a ledge to develop will be minimized. The endodontic literature provides much information that can help to prevent procedural errors such as ledge formation. It is also true that experience can teach many valuable lessons if one pays attention at all times. Put another way, each operator should learn from his/her own mistakes as well as from those of other people, and this is surely true of endodontic mishaps as well. Treatment evaluation and critical analysis of one's own work can help prevent future occurrences.(19) The use of accurate preoperative and "working" radiographs to determine the root canal length, copious irrigation, precurved files, and incremental instrumentation will all greatly reduce the chance of ledge formation occurring (20) Moreover, caution must be used in attempting to recover from a blockage of the canal, especially when it occurs at a curve or bend in the canal direction. An all too common and unfortunate result is the creation of a ledge and oral lateral perforation in such a situation. Some important considerations in prevention of this iatrogenic error are discussed below.(21)

CONCLUSION

Endodontic failure still occur despite technological advancements in the field of dental instrumentation and materials. Endodontic procedural errors are not the direct cause of treatment failure. The technological boom in endodontics has provided the methods and instruments that allow successful treatment of teeth with calcified chambers, calcified canals, severe root curvature, ledging, resorptive defects, perforations and canal blockage due to separated instruments. With enhanced magnification by operating microscope, direct lighting, use of ultrasonics, NiTi instruments, multiple delivery systems for obturation, almost all procedural errors during endodontic therapy can be minimized or prevented/ successfully treated with predictable prognosis (22)

References

1. IngleJI, BaklandLK.Endodontics. 5th ed. London: BCDeckerInc, 2002; 412,482-9, 525-38, 695, 729, 769, 776-85.
2. CohenS, Burns RC. Pathways of the pulp. 8th ed. St Louis: Mosby, 2002:94, 242-52, 530, 870, 910-6.
3. NagyCD, BarthaK, BernathM, VerdesE, SzaboJ. The effect of root canal morphology on canal shape following instrumentation using different techniques. *Int Endod J* 1997; 30:133-40.

4. Kapalas A, Lambrianidis T. Factors associated with root canal ledging during instrumentation. *Endod Dent Traumatol* 2000; 16:229-31.
5. Harty FJ, Parkins BJ, Wengraf AM. Success rate in root canal therapy: a retrospective study of conventional cases. *Br Dent J* 1970;128:65-70
6. Namazikhah MS, Mokhlis HR, Alasmakh K. Comparison between a hand stainlesssteel K file and a rotary NiTi 0.04 taper. *J Calif Dent Assoc* 2000; 28:421-6.
7. Greene KJ, Krell KV. Clinical factors associated with ledged canals in maxillary and mandibular molars. *Oral Surg Oral Med Oral Pathol* 1990; 70:490-7.
8. Gutmann JL, Dumsha TC, Lovdahl PE, Hovland EJ. Problem solving in endodontics. 3rd ed. St Louis: Mosby, 1997:96-100, 117.
9. CohenS, HargreavesKM. Pathways of the pulp.9thed. StLouis: Mosby, 2006:992-4.
10. Lambrianidis T. Ledge formation. In: Iatrogenic complications during endodontic treatment. Thessaloniki, Greece: Univ Studio Pr, 1996.
11. Walton RE, Torabinejad M. Principles and practice of endodontics. 3rd ed. Philadelphia: WB Saunders, 2002:184, 222-3, 319-20.
12. Weine F. Endodontic therapy. 5th ed. St Louis: Mosby, 1996:324-30, 545-7.
13. Ingle JI. A standardized endodontic technique utilizing newly designed instruments and filling materials. *Oral Surg Oral Med Oral Pathol* 14:83-91, 1961.
14. Weine FS, Kelly RF, Lio PJ. The effect of preparation procedures on original canal shape and on apical foramen shape. *Journal of Endodontics* 1(8):255-62, 1975.
15. Morgan LF, Montgomery S. An evaluation of the crown-down pressureless technique. *J Endod* 10(10):491-8, 1984.
16. Torabinejad M. Passive step-back technique. *Oral Surgery, Oral Medicine, Oral Pathology* 77(4):398-401, 1994.
17. Wu MK, van derSluis LW, Wesselink PR. The risk of furcal perforation in mandibular molars using Gates-Glidden drills with anticurvature pressure. *Oral Surg Oral Med Oral Pathol Oral RadiolEndod* 99(3):378-82, 2005.
18. Roane JB, Sabala CL, Duncanson MG, Jr. The "balanced force" concept for instrumentation of curved canals. *Journal of Endodontics* 11(5):203-11, 1985.
19. Parris J, Wilcox L, Walton R. Effectiveness of apical clearing: histological and radiographical evaluation. *Journal of Endodontics* 20(5):219-24, 1994.
20. Ferreira Murgel CA, Walton RE, Rittman B, Pecora JD. A comparison of techniques for cleaning endodontic files after usage: a quantitative scanning electron microscopic study. *J Endod* 16(5):214-7, 1990.
21. Chang YC, Tai KW, Chou LS, Chou MY. Effects of camphorated parachlorophenol on human periodontal ligament cells in vitro. *J Endod* 25(12):779-81, 1999.
22. Endodontic Failures and its Management: A Review SumanChaurasiya1, GunjanYadav2, Abhay Mani Tripathi3, KavitaDhinsa4