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José Azael Durán Hernández
Master of Sciences Student,
Universidad Autonoma de Nuevo
Leon, Facultad de Odontología,
Monterrey, Nuevo Leon, CP 64460,
Mexico

**Maria Argelia Akemi Nakagoshi
Cepeda**
Profesor, Universidad Autonoma de
Nuevo Leon, Facultad de
Odontología, Monterrey, Nuevo Leon,
64460 ZIP, Mexico

Violeta Isabel Quintero Salazar
Profesor, Universidad Autonoma de
Sinaloa, Facultad de Odontología,
Culiacan, Sinaloa, 80013 ZIP, Mexico

Julio Benitez Pascual
Profesor, Universidad Autonoma de
Sinaloa, Facultad de Odontología,
Culiacan, Sinaloa, 80023 ZIP, Mexico

Efigenia Moreno Terrazas
Profesor, Universidad Autonoma de
Sinaloa, Facultad de Odontología,
Culiacan, Sinaloa, 80013 ZIP, Mexico

Alfonso Castañeda Martinez
Profesor, Universidad Autonoma de
Nayarit, Secretaria de Investigacion y
Posgrado, Tepic, Nayarit, 63000 ZIP,
Mexico

Carlos Benitez Valle
Profesor, Universidad Autonoma de
Nayarit, Secretaria de Investigacion y
Posgrado, Tepic, Nayarit, 63000 ZIP,
Mexico

Dr. Juan Manuel Solís Soto
Profesor, Universidad Autonoma de
Nuevo Leon, Facultad de
Odontología, Monterrey, Nuevo Leon,
64460 ZIP, Mexico

Corresponding Author:
Dr. Juan Manuel Solís Soto
Profesor, Universidad Autonoma de
Nuevo Leon, Facultad de
Odontología, Monterrey, Nuevo Leon,
64460 ZIP, Mexico

Endodontic methods for retreatment of periapical lesions: A review

José Azael Durán Hernández, Maria Argelia Akemi Nakagoshi Cepeda, Violeta Isabel Quintero Salazar, Julio Benitez Pascual, Efigenia Moreno Terrazas, Alfonso Castañeda Martinez, Carlos Benitez Valle and Dr. Juan Manuel Solís Soto

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Abstract

Introduction: Preserving the dentition and ensuring that it fulfills its functions are the main objective of endodontic treatment. When the periapical lesion persists, it is necessary to review the retreatment alternatives.

Objective: To analyze the literature and compare the efficacy of non-surgical endodontic procedures, such as apical surgery, intentional reimplantation and dental extraction with implant placement as procedures for retreatment of periapical lesions.

Methodology: A literature review was carried out in PubMed and Google Scholar databases using the keywords: "periapical lesion", "intentional replantation", "apical surgery", "non-surgical root canal treatment" "tooth extraction", and Boolean parameters AND, OR and NOT.

Results: Non-surgical endodontic retreatment is usually the first choice, files are used to remove the obturation material, although in some cases, since it is not possible to remove it completely, it is not enough to properly disinfect the canals. Apical surgery is a viable option in cases where non-surgical root canal treatment is not possible, such as calcified teeth or extruded material. Intentional reimplantation offers the advantage of working in areas that are difficult to access and decreasing working time. Tooth extraction and implant placement should be considered as a last option, as it can generate loss of function and esthetic problems. Implant placement maintains the bone structure and soft tissues for a longer period of time.

Conclusion: The adequate selection of cases to apply the different treatments will improve the prognosis. Preserving teeth in the best possible condition at the time will always be the best option.

Keywords: Periapical lesion, intentional replantation, apical surgery, non-surgical root canal treatment, tooth extraction

1. Introduction

Preserving the dentition and ensuring that it continues to fulfill its normal functions is the main objective of endodontic treatment, but when this fails, it is necessary to review the different retreatment alternatives to resolve this situation, and although it is also a solution, dental extraction should be left as a last resort, since it can generate changes in the alveolar bone, thus compromising future prosthetic rehabilitation [1, 2].

Endodontic treatment consists of chemical disinfection and mechanical shaping of the root canals of an infected tooth and its obturation with gutta-percha and sealing cement [3]. Its failure is usually caused by the presence or persistence of bacteria inside the root canal or extraradicular areas, these become resistant to disinfection measures, form biofilm and are located in areas of difficult access [4, 5].

There are different treatment options such as non-surgical root canal retreatment, which consists of the removal of root canal filling materials, and a new disinfection, shaping and filling [6]. And other surgical type treatments, such as apical surgery with retrograde retreatment or intentional reimplantation, which is defined as the removal of the infected tooth, followed by the extraoral therapeutic procedure and its reimplantation in the same alveolus,

used once non-surgical retreatment or apical surgery has not worked or is contraindicated [7, 8]. As a last option tooth extraction should be considered, its absence generates atrophy of the surrounding alveolar bone [9], so it is advisable to place an implant with its restoration, which replaces the function of the lost tooth.

The need has been detected for a review that identifies and compiles the characteristics and applications of the different procedures for retreatment of periapical lesions. The objective of this review is to analyze the literature and compare the procedures of non-surgical endodontic retreatment, apical surgery, intentional reimplantation, and dental extraction with implant placement.

2. Materials and methods

Articles on the subject published through the PubMed, SCOPUS and Google Scholar databases were analyzed, with emphasis on the last 5 years. The quality of the articles was evaluated using guidelines, i.e., identification, review, choice and inclusion. The quality of the reviews was assessed using the measurement tool for evaluating systematic reviews. The search was performed using Boolean logical operators AND, OR and NOT; with the keywords: "periapical lesion", "intentional replantation", "apical surgery", "endodontic retreatment", "non-surgical root canal treatment" "tooth extraction", "dental implants". The keywords were used individually, as well as each of them related to each other.

3. Results and Discussion

3.1 Non-Surgical Endodontic Retreatment

The main cause of endodontic treatment failure is the persistence of infection, the main objective of retreatment is to perform root canal disinfection and shaping again by previously removing the material that was in place [10, 11].

Endodontic treatment failure is also associated with insufficient disinfection, poor obturation, inadequate coronal restoration, untreated root canals, iatrogenic errors during access design or limited instrumentation, and complications such as perforations or fractured instruments [12]. However, there are situations where the procedure has had the highest standards and continues to fail, this due to bacterial persistence, and in some cases extraradicular infections may also be related in situations of failure [13].

In addition, the technical quality of root canal treatment and retreatment depends on several risk factors such as canal curvature and morphology [14]. For this reason, due to the inability to make contact with all the walls of the dentin it is at this point where chemomechanical preparation takes on greater relevance thanks to its ability to remove debris, disinfection of the canal and lubricating effects during the procedure [15].

Hand and rotary instruments are used to remove the previous endodontic filling material, removing it correctly from the root canal walls may be related to the metallurgical properties and recommended movements of the instrument, which help the clinician to reach the hard-to-reach areas, which would allow more disinfection with less dentin wear [16]. Likewise, a good obturation is one that covers the entire canal area without leaving gaps and thus inactivates irritants that could not be removed during disinfection [17].

Perform coronal access and removal of root canal filling material (can be with Gates Glidden burs, Headstrom files (H-files) or rotary instruments; determine working length; irrigation with 2.5% NaOCL during the whole treatment and final irrigation with 2.5% NaOCL activating it with

Endoactivator system (Dentsply Sirona) for 30 seconds, followed by sterile saline solution and subsequent use of 17% EDTA, again final rinsing with sterile saline solution and drying with sterile paper tips; disinfection with 2.5% NaOCL for 3 minutes of gutta-percha master cones; obturation with gutta-percha tips and resin-based root canal sealer (AH plus) by lateral compaction technique [18].

In one investigation, non-surgical retreatment was performed on 351 teeth with success rates of 65.5% [19]. While other articles mention an average success rate of 78% [20] and 80.6% [21] for non-surgical endodontic treatment. The success rate can be increased with the use of materials that guarantee correct adhesion and stability [22].

Non-surgical endodontic retreatment is usually the treatment of first choice against persistent periapical lesions, as it is the least aggressive. Hand and rotary instruments are mainly used to remove the obscuration material, although sometimes, since it is not possible to remove it completely, it is not enough to properly disinfect the canals.

3.2 Apical Surgery

Apical surgery or surgical retreatment of the canal is performed when endodontic treatment has failed and conventional or non-surgical retreatment has been ineffective or contraindicated [23]. Compared to non-surgical retreatments, this type of retreatment after 2 years of follow-up proves to be predictable and to have a lower risk of failure [24], and even using the endoscope it is possible to increase the success rate [25].

The frequency of neurosensory alterations after apical surgery is higher in second premolars compared to other groups of teeth, due to the proximity of the mentioning foramen [26].

3.2.1 Advantage It is possible to maintain the affected tooth after removal of the periapical lesion.

3.2.2 Disadvantages: Decreases root length and exposes apical dentin due to cement removal during surgery [26].

3.2.3 Indications: Calcified or obstructed canals; extruded material; failed or inappropriate root canal retreatment (isthmus tissue, persistent symptoms, risk of root fracture); perforations [27].

3.2.4 Contraindications: Inaccessible root end; tooth with inadequate or non-restorable periodontal support; uncooperative patient or with compromised clinical history [27].

3.2.5 Protocol: Full thickness mucoperiosteal flap reflection, followed by osteotomy and resection of approximately the last 3 mm of the apex, preparation with ultrasonic tip and retrograde obturation with biodentine at the now root end [28, 29].

3.2.6 Success rate: The long-term outcome of this procedure has shown success rates of 78 to 91% after a follow-up of 2 to 13 years. It is predictable when proper techniques are used and is associated with biocompatible and bioactive root filling materials [30].

Apical surgery is a treatment option that offers the possibility of retreatment of endodontic cases and even retreatments that have failed. It is also a viable option in cases where non-surgical root canal treatment is not possible, such as calcified teeth or extruded material, thus allowing the affected tooth to be maintained for a longer period of time.

3.3 Intentional Reimplantation

Surgical procedure based on the controlled extraction of the affected tooth, to revise the root surface and perform endodontic treatment extraorally, followed by its repositioning in the original socket^[31]. Proper case selection, atraumatic extraction, minimal extraoral time and aseptic techniques are the key factors for successful treatment^[32].

3.3.1 Advantages: It is possible to repair directly in difficult to access areas of the tooth without damaging adjacent tissues and with good case selection is easier to perform than apical surgery. For the patient it has advantages such as reduced consultation time, complications and cost, compared to apical surgery^[33, 34].

3.3.2 Disadvantages: Due to possible damage to the periodontal ligament and likelihood of external root resorption, some clinicians consider it as a last option^[34].

3.3.3 Indications: If extensive osteotomy is necessary to perform apical surgery; in cases of odontogenic maxillary sinusitis; when other endodontic treatments have failed; anatomical factors that make access difficult to perform apical surgery; suspected root fracture without its definitive diagnosis; and periodontally compromised teeth^[33].

3.3.4 Contraindications: immunocompromised/suppressed patients, teeth with high potential risk of fracture/trauma (teeth with divergent roots), poor patient compliance and oral hygiene. Teeth with periodontal involvement or fractured teeth may have a poorer prognosis with RI, although an excellent biomaterial for these cases is under investigation^[33].

3.3.5 Protocol: The patient should perform mouth rinse with 0.12% chlorhexidine gluconate prior to the procedure; local anesthesia; atraumatic extraction, followed by inspection of the root with magnification and staining with dye; during the procedure the tooth should be held in sterile moist gauze, with fingers or forceps, avoiding touching the root and constantly irrigated with sterile saline or Hank's solution; obturation of the root end with Endo Sequence BC or ProRoot MTA; before reimplantation, it is advisable to gently curettage the socket to remove granulosomatous tissue and irrigate it with sterile saline solution; the tooth is gently reimplanted in its socket, if it is mobile ask the patient to bite on gauze for 10 minutes more; if necessary, perform occlusal adjustment^[35].

3.3.6 Success rate: The success rate for teeth reimplanted with uni-rooted teeth is 89.3%, while the success rate for teeth reimplanted with multi-rooted teeth is 84%. An average success rate of 86.7% is currently estimated^[36]. If the reimplanted teeth are diagnosed with apical abscess, the risk of failure increases 2.7 times^[37].

Intentional replantation is indicated in cases where apical surgery may be contraindicated, or other endodontic treatments have failed. It offers the advantage of working in areas that are difficult to access and reducing working time, and with proper case selection, aseptic techniques and respecting the steps of the protocol, a high success rate.

3.4 Tooth Extraction and Implant Placement

Dental extractions are performed for different reasons, such as extensive caries, periodontitis or impacted third molars. Although in some cases, this may be considered an overtreatment, therefore, it is necessary to be sure when it will

be indicated, because the absence of dental organs can trigger disuse atrophy of the bone, decreasing up to 50% of the ridge width after 1 year^[9, 38, 39].

The healing process of the alveolus after tooth extraction is a process divided into four stages: blood clot phase; inflammation phase of granulation tissue formation; proliferation phase with bone tissue formation; remodeling phase^[40]. Placement of platelet-rich fibrin in the treatment of alveoli after extraction increases healing efficacy, reduces postoperative pain, and prevents bone loss^[41].

Dental implants are a treatment for the replacement of missing teeth, bone resorption is often a complication, which studies have shown that if the dental root remains in the alveolar process, bone resorption is minimal^[42].

Freehand implant placement obviously tends to generate more errors as it has less precision; in the case of static methods the deviation is smaller (<2 mm), but in some cases has a slight angulation imprecision (<5°); on the contrary, the dynamic navigation approach has more advantages in precision and speed of adjusting the location during surgery, causes less trauma and better posture for the clinician^[43].

3.4.1 Protocol: Extraction of the tooth atraumatically with extreme care to preserve bone and adjacent tissue; remove granulation tissue and rinse with sterile saline. Immediate implant placement, plus deproteinized bovine bone mineral (DBBM) and autogenous bone graft. In case of implant placement after a prolonged time after extraction it is necessary to use a surgical guide, it is placed in the mouth, stabilized, followed by an approach with or without a flap^[44, 45].

3.4.2 Recommendations: Antibiotics may be prescribed prior to tooth extraction to prevent complications caused to infection; Extraction as an emergency only perform in patient with blood glucose ≤ 234 mg/dl, administer LA without adrenaline and antibiotic for 5 to 7 days after extraction^[46, 47].

3.4.3 Success rate: Immediate loading implants have a success rate of 84.1%, while delayed loading implants show a 97.7% success rate^[48].

Dental extraction and implant placement should be considered as the last treatment option, only if the prognosis is unfavorable should these measures be taken to reverse it and prevent further affection, it should be carefully considered whether to perform it or not because that can cause the patient's quality of life to decrease, generating loss of function of the oral cavity and esthetic problems. The implant placement maintains the bone and soft tissue structure for a longer period of time.

4. Conclusions

All the procedures mentioned above offer an option to eliminate the persistent periapical lesion in cases of endodontic failure; however, it is important to consider the characteristics of the cases where they will be applied in order to improve the prognosis and to allow preservation of the teeth and periodontal tissues for a longer time fulfilling their functions. Therefore, in spite of offering certain benefits such as the preservation of hard and soft tissues, dental extraction and implant placement should be the last treatment option for any case.

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