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Apical Root Resorption, Microapical Surgery Management of Root Resorption

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Abstract

When the apical root is removed during apical surgery, the crown-to-root ratio is altered in a manner that is not desirable. The crown-to-root ratio has been utilized for teeth that have periodontal disease. It is important to note that apical root excision is not the same as periodontal bone loss here. Microsurgery in endodontics allows for the realization of a 0 degree or shallow bevel, as well as the precise length of root excision, and it also reduces the width of the osteotomy in the longitudinal direction. For the purpose of determining the prosthodontic prognosis of the teeth that have been apically removed, the crown-to-root ratio is not an acceptable metric. For the purpose of preventing endo-perio communication, it is vital to perform endodontic microsurgery with precision in order to protect the buccal bone.

Keywords*: apical root, crown-to-root ratio, periodontal disease.*

Introduction

IRR, which stands for internal root resorption, is a term that describes the process by which dental hard tissue is lost as a result of osteoclastic activity within the root canal space. IRR is an extremely uncommon occurrence that can express itself in either a gradual or a very quick progression. Inflammation of the pulpal tissue that is chronic and the loss of predentin as a result of trauma are both regarded to be possible risk factors for intraoral recombination

[1]. In most cases, IRR is asymptomatic and is discovered by accident during normal radiography tests. It is possible for IRR to manifest as radiolucent enlargements of the root canal space that are either round or oval in shape, and they have well defined edges. Shifted radiographs do not alter the spatial relationship of the canal to the resorptive item being examined. Multinucleated giant cells can be seen in Howship's lacunae, which are located within the resorbed portion of the root, in histological samples representing IRR. It is possible for damaging alterations to occur in the periodontal ligament (PDL) and bone if the IRR defect reaches the external root surface and perforates the root [2].

The absence of pain, swelling, and other symptoms, the absence of sinus tract activity, the absence of loss of function, and the presence of radiographic evidence of intact periodontal ligament are all indicators that the nonsurgical root canal treatment was successful. The resolution of apical radiolucency and signs of a re-establishment of the lamina dura are two additional excellent indicators that indicate a favorable prognosis. The extent of the root filling material at the apical level is one of the clinical parameters that has a significant impact on the outcome of root canal treatment. When root filling material is extruded beyond the apical termination into the surrounding tissue, it can cause the healing process to be delayed or even result in the treatment being unsuccessful due to a reaction to the foreign body [3].

A sixteenfold rise in the frequency of apical periodontitis was observed when cone beam computed tomography (CBCT) was employed as the preferred method of radiographic imaging [3]. The incidence of apical periodontitis in teeth with root canal obturation at 1 mm beyond the apex was found to be eighty percent. This can be an indication of contamination with dentin extrusion, irrigation solution, and filling materials, all of which are irritants in the periapical tissue [4]. Root filling material that extends beyond the root can be a sign of this contamination. When root filling is extruded, it is because of the loss of the apical stop that occurs during the cleaning and shaping processes, as well as the absence of continuous length control. Interappointment flare-ups and postoperative discomfort are two of the most major complications that can arise as a result of apical extrusion during root canal treatments. These difficulties are undesirable for both the patient and the practitioner, and they are one of the most serious complications that can arise as a consequence of those procedures [4].

It is possible that a root filling material that emits components such as formaldehyde and eugenol would create a significant inflammatory response. In order to prevent these compounds from causing damage to surrounding essential structures like nerve bundles, it may be necessary to perform surgical intervention as soon as possible. In the event that the patient presents with symptoms such as paraesthesia, pain, and edema, surgical intervention is a management strategy that has been demonstrated to alleviate the symptoms. This therapy strategy is expected to be effective. Researchers have demonstrated that endodontic microsurgery performed with contemporary procedures has a success rate of 94% [5].

Due to the fact that it does not meet the criteria for success that were discussed earlier, the endodontic treatment that was performed in this case report did not deliver a favorable outcome. The patient continued to have pain despite the fact that the obturation looked to be homogenous and it did not contain any voids. The management of post-treatment apical periodontitis, which is primarily induced by the extrusion of foreign material, is therefore treated in detail. Endodontic microsurgery is performed for this purpose. Over the course of its history, endodontic microsurgery has seen significant development, which has resulted in the treatment becoming more accurate, comprehensive, and predictable. The utilization of ultrasonic tips, high-power magnification, and lighting are all examples of contemporary technology utilized in endodontic microsurgery surgeries. As an example, micro-mirrors are instruments that are meant to modify smaller areas without causing an excessive amount of damage to the tissue. It has been suggested that

biocompatible materials should be used in place of amalgam in order to promote better healing of the periapical tissues [6].

Review:

The beginning of endodontic therapy ought to be started as quickly as possible after the identification of IRR. On the other hand, imperfections in the root canal area frequently make it extremely challenging to do full cleaning, shaping, and obturation of the canal procedure. Endodontic treatment should be followed by a hermetic seal of the perforation site using a biocompatible sealing material [7]. This may be necessary in the event that an IRR defect causes a root to become perforated.

There have been reports of successful treatment outcomes for the repair of perforated internal resection of the ureter (IRR) with mineral trioxide aggregate (MTA) using both surgical and nonsurgical methods on patients. In addition to being biocompatible and possessing excellent sealing qualities, MTA is able to set in the presence of blood and/or moisture. When employed as a root-end filling or perforation repair material and placed in touch with periradicular and periodontal tissues, MTA has the ability to stimulate cementogenesis and osteogenesis [8]. This is particularly true when the material is utilized to treat perforations.

Calcium enhanced mixture cement, often known as CEM cement, is a type of cement that is tooth-colored and is composed of calcium silicate. It has the ability to set when moisture is present. In spite of the fact that its chemical makeup is distinct from that of MTA, it has been demonstrated in both ex vivo and in vivo investigations that its low cytotoxicity is equivalent to that of MTA. CEM cement has also been shown to have great biocompatibility, which has been demonstrated through research conducted on both humans and animals. In addition, CEM cement has demonstrated strong long-term sealing capabilities [9], making it a suitable material for obturation.

The complete cleansing of the resorptive lacuna and the sealing of the defect with an appropriate biocompatible material are two of the most important components in the effective treatment of intrarespiratory resuscitation (IRR). When IRR perforates root structure and develops a communication between the root canal space and the PDL, it becomes more difficult to achieve the aforementioned aims of cleaning and closing off the defect, and in certain cases, it is even impossible to do so. In the event that the clinician is unable to exert control over the filling material through the utilization of an orthograde technique, another option is to explore surgical intervention. Repair of a perforation, on the other hand, could not be possible in some circumstances, such as when the site of the perforation is not accessible through surgical means. Examples of such occurrences are interproximal perforations, which occur when the root proximity with adjacent teeth becomes an issue, and palatal root perforations, which occur in the maxillary anterior teeth. Three-dimensional imaging with cone beam computed tomography (CBCT) is a helpful technique that can display the position of the lesions and any perforation(s) that may not be discernible on two-dimensional periapical radiographs [10]. It can also illustrate the size of the resorptive lesion, which is a beneficial feature. There is also the possibility that CBCT will be of assistance to the clinician in developing the best effective treatment strategy for the patient. An insufficient obturation of the resorptive lacuna and a faulty sealing of the perforation were the results of the orthograde method in this particular instance, which was unable to fully satisfy the treatment aims. Furthermore, the orthograde method of treating resorptive defects offered only a low probability of entirely eliminating all resorptive tissues and totally disinfecting the root canal. This was the case because the orthograde method was ineffective. On the other hand, the surgical method enabled the clinician to have a better view of the entire defect and to thoroughly remove all of the granulation tissues. It was also possible for the provider to stop bleeding prior to obturation, clean the apical third of the root canal using ultrasonic tips, and ultimately close off the root canal and all resorptive

lacuna through the use of surgical therapy for resorptive defects [11].

The results of treatment following the extrusion of MTA into periapical lesions have been demonstrated to be unpredictable in previous study. One of the most important points to consider is the possibility that MTA will not harden after being extruded into periapical lesions. It has been demonstrated that environmental conditions have an effect on the manufacturing process as well as the physical qualities of MTA. To give just one example, the capacity of MTA to seal, the strength of its push-out bond, and its surface hardness all drastically decrease when exposed to acidic environments. It is possible for MTA to come into contact with pus, blood, or exudates when it extrudes into an inflammatory lesion. Pus that has been collected from periapical lesions appears to have an acidic pH. In addition, the presence of serum and blood contamination during the setting process results in a reduction in the compressive strength and surface hardness of MTA, as well as a change in its superficial microstructure. Based on the fact that extruded MTA was not found during the surgical procedure, it is highly probable that the MTA did not set after it was placed [12].

MTA is a biomaterial that is osteoconductive and has the ability to increase the production of bone markers like alkaline phosphatase, which is an essential enzyme that is required for the creation of bone. There is a very low level of cytotoxicity and biocompatibility with Set MTA. Both the osseous healing of the lesion that the MTA was extruded into and the resorption of the extruded MTA have been documented radiographically in clinical accounts. The histology evidence for this link was not provided, despite the fact that one of these investigations demonstrated a correlation between extruded MTA and persistent endodontic illness. Furthermore, the results of the histological examination of the current instance demonstrated the presence of minute particles of MTA that had been phagocytosed by multinucleated large cells throughout the lesion. Nevertheless, a comprehensive chemical analysis was not performed on these particles in order to verify the chemical composition of the particles. We made the assumption that these were MTA particles based on the patient's dental history as well as the radiographs that were taken in the past. This presumption requires additional research to be conducted. In contrast to unset MTA, which has a distinct composition, set MTA has a different composition, and the tissue reaction to the latter is always unknown. In spite of the fact that there is no information regarding the environment in which the extruded MTA was found in this instance, the histology data demonstrates that the tissues exhibited an inflammatory response to the MTA particles. Inadequate cleaning of the root canal area and the existence of chronic infection arising from the main treatment may be additional reasons for the inflammatory infiltrate that is present in the lesion. It is important to note that both of these factors are possible potential causes. The histological sections could be stained with bacteria-specific staining, which has the ability to reveal whether or not bacteria are present in the lesion [13].

However, the pre-operative radiograph did not reveal any radio-opaque particles, despite the fact that the histological investigation of the tissues revealed the presence of MTA particles within the lesion. The majority of MTA is made up of tricalcium and dicalcium silicate, which, when hydrated, results in the formation of calcium-silicate-hydrate gel as well as calcium hydroxide products. Bismuth oxide, which is the opacifier in MTA powder, is present in the powder in two different forms: as unreactive filler particles and as a component of the structure of calcium-silicate-hydrate when the material has been fully hydrated. In order to explain the entire radiographic disappearance of the extruded MTA, it was hypothesized that the complete absorption of hydrated MTA, which included both the unreacted and the hydrated bismuth oxide, was responsible for the phenomenon. On the other hand, the histology data from this particular example provide evidence that MTA may be present in the tissue even when it is not evident on radiographic examination. To put it another way, it is possible that inflammatory cells were able to eliminate bismuth oxide at a higher rate

than the MTA as their entirety. Nevertheless, this presumption ought to be validated by doing an elemental analysis on the specimen in question, and this entails conducting additional research on the subject. It is also possible that the MTA particles are too minute to be seen radiographically [14]. This is another possibility.

The goal of conventional endodontic therapy is to eliminate bacteria from the root canal system and to create robust barriers that will prevent root recontamination. 1. In order for endodontic therapy to be successful, the entire root canal system needs to be cleansed, shaped, and filled from the inside out. In traditional root canal therapy, failure causes are typically associated to the presence of persistent bacteria (permanent infection) or reinfection in a canal that has just been cleansed and sanitized (secondary infection). [15] This is because both of these types of infections can occur in the same canal.

It is possible to attribute the failure of endodontic therapy to extraradicular infections such as periapical actinomycosis, foreign body reactions that can be brought on by the extrusion of endodontic material, the accumulation of endogenous cholesterol crystals in the apical tissues, and cystic lesions that have not been treated. The achievement of success is contingent upon a multitude of factors, which are validated through clinical and radiographic examinations over the subsequent period of follow-up [15].

When it comes to teeth that have been subjected to conventional therapy but still have a persistent periapical lesion, retreatment may be the initial therapeutic option that is considered. Accidents that occur during traditional treatment may have a detrimental effect on the outcomes of the treatment by increasing the risk of infections developing in apical regions that are difficult to access and ultimately requiring surgical intervention.

Because it has such a high success rate, nonsurgical endodontic therapy for periapical lesions is a therapeutic method that is frequently used and relied upon. Despite this, there are a number of compelling reasons to undergo endodontic surgery. There is a common practice of delaying endodontic surgery in the posterior region in favor of tooth extraction, implant insertion, or purposeful replantation of mandibular premolars and molars. This is done when endodontic surgery is required in the posterior region. In cases where endodontic surgery is deemed necessary in the anterior region, it is normally carried out without any prior reservations. The maxillary sinus and the mandibular canal are two examples of anatomical features that may play a role in the decision to forego endodontic treatment in the posterior region [16]. Other factors that may contribute to this decision include the restricted access to this area of the oral cavity and the lack of experience of the operator.

Conclusion:

Apical root excision does not lower the periodontal bone support as much as the loss of the crown-to-root ratio. As a result, the standard of crown-to-root ratio should be re-visited within the context of evaluating the prosthodontic prognosis of the teeth that have been apically resected. Because the amount of total supported root surface that is lost as a result of apical resection is reduced, and because the occlusal stress is concentrated on the cervical region rather than the apical region. A decrease in the longitudinal distance between the alveolar bone edge and the resected root end, on the other hand, can enhance the likelihood of endo-perio communication that occurs. Therefore, the evaluation of the marginal bone and the gingiva that is related to it, as well as the precise execution of endodontic microsurgery, are the essentials for the preservation of the buccal bone.

There have been a great number of research that have concentrated on the quest for a restorative material that possesses strong sealing qualities and biocompatibility for the treatment of teeth that have open apices and necrotic pulps. These conditions can be the result of periradicular illness and root

resorption. Mineral trioxide aggregate, also known as MTA, has demonstrated encouraging clinical results in the treatment of root perforations, root resorptions, incomplete root forms, and pulpal necrosis. It has also been used in retrograde fillings and pulpotomies.

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