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Introduction

Bacteria and their by-products are the main causative factors of infections in the pulp and the periapical area. The aim of modern endodontics is to eliminate or reduce the bacterial load to levels compatible with the healing process. This can be achieved by adequate root canal shaping, appropriate 3-D cleaning and finally complete obturation of the complex root canal system with thermoplasticised gutta-percha. The previously listed procedures can treat irreversible pulpitis or eliminate a periapical and/or lateral lesion of endodontic origin. However, even if carried out correctly, a short or long-term success cannot be guaranteed from the structural point of view.

One of the major causes of postoperative root canal therapy failures, leading to extraction of the treated tooth, is tooth fracture due to insufficient remaining tooth structure. For this reason, if correct and modern endodontic treatment is combined with a minimally invasive access design, which provides the room to explore and conserve as much of the tooth structure as possible, greater durability will be assured for the treated tooth.

The success of endodontic treatment depends on identifying, exploring and completely treating all of the complex root canal system. This goal can be accomplished through possessing the requisite knowledge and exploring the anticipated canal system using the newest technologies. Throughout the past few years, minimal access cavity preparation and its disadvantages have been topics of much debate. The objective of this article is to discuss when it is possible to create conservative access cavities in endodontic treatment, how this should be done and why.

When?

A minimally invasive access cavity can be prepared only if the following considerations can be entirely realised:
- direct visualisation of the entire floor of the pulp chamber and ability to fully explore the anatomy of the pulp chamber
- ability to localise all of the anticipated canal orifices
- complete removal of any present calcifications on the floor of the pulp chamber
- ability to prepare the isthmuses in premolars with two root canals
- likewise, ability to prepare the mesial isthmuses in mandibular molars
access allows exploration and cleaning of the pulp chamber without removing the pulp horns and with minimal removal of the roof.

According to these points, we consequently discuss in which clinical situations preparing a conservative access cavity is recommended.

Teeth with irreversible pulpitis or necrosis due to Class V cavities
After removal of the caries, a sound occlusal surface can be obtained. Therefore, in this case, it is advised to prepare a conservative access cavity in order to preserve the tooth structure. This applies likewise to teeth with irreversible pulpitis or necrosis due to proximal caries that does not extend to the occlusal surface. In these cases, after eliminating the entire carious lesion, it is possible to extend the preparation a little bit occlusally to perform the endodontic treatment through a mesial or distal cavity.

Teeth with irreversible necrosis or necrosis caused by preparation below crowns and bridges
In such cases, if the pulpal pathology is due to the preparation of the teeth and provided that no carious lesion exists and the crown or a bridge has definitive margins, it is ideal to prepare a conservative access cavity for structural and aesthetic reasons.

Figs. 3a–c: Cleaning the isthmus with an ultrasonic tip for endodontic surgery. The tip was used to remove calcification and shape the isthmus, with mesial access to preserve the occlusal surface. Figs. 4a–c: Cleaning the isthmus with an ultrasonic tip for endodontic surgery. The tip was used to remove calcification and shape the isthmus, with mesial access to preserve the occlusal surface. Fig. 5: Pre-op periapical radiograph of tooth #16, which presented with mesial caries. Fig. 6: Cleaning the pulp horns with an ultrasonic tip. Fig. 7: Post-op periapical radiograph, in which the preserved tooth structure can be seen. Fig. 8: Post-op periapical radiograph, in which the preserved tooth structure can be seen.
Teeth with irreversible pulpitis or necrosis caused by periodontic-endodontic lesions with no or minimal occlusal caries

Severe periodontal disease can lead to pulpal pathology, while the tooth structure can be intact and sound. In such cases, a small conservative access cavity can aid in maintaining the integrity of the affected teeth. This applies similarly to cases of teeth with irreversible pulpitis or necrosis due to trauma or hazardous occlusal stresses.

How?

The conservative design of access cavities can be applied only when the operator has adequate experience and with the aid of modern technologies, such as a dental operating microscope, ultrasonic tips, modern nickel-titanium rotary files and modern 3-D cleaning. Only under high magnification and with an efficient light is it possible to visualise, through the small access cavity, the entire floor of the pulp chamber, all of the root canal orifices, the main canals, the accessory canals and any obstructions, such as calcifications. Therefore, the use of the operating microscope in preparing such small access cavities is crucial.

Preparing a conservative access cavity is done under the operating microscope and drilling with long shank burs of small diameter (0.8–1.0 mm), for better visibility, to penetrate the pulp chamber. Once in the chamber, irrigation with sodium hypochlorite is done in order to eliminate any debris. Afterwards, using a K-type file of small diameter (0.08 mm), the root canals are probed and explored. Subsequently, any calcifications are visualised under magnification, then removed with ultrasonic tips. If some of the root canals cannot be found at this point, they can be located using ultrasonic tips while cutting into the floor of the chamber.

One of the important points in the conventional extended access opening cavity is the complete removal of the pulp chamber roof (which is important to avoid bacterial contamination from pulp residue). However, with the modern method of conservative access cavity preparation, this excessive removal of dentine can be avoided by completely cleaning all of the roof of the pulp chamber without leaving any pulp residue. This can be accomplished using ultrasonic tips designed for endodontics. In this case, it is advised to use a small ultrasonic tip with a small round diamond end or an ultrasonic tip designed for periapical surgery. Such special ultrasonic tips are able to clean the pulp horns and the remaining roof without removing any valuable tooth structure (Figs. 1 & 2).

An additional point, which was very important in the past, is that the insertion of the files into the root canals must be done in a perpendicular direction to the occlusal surface of the tooth. In order to achieve such an entrance to the canals, sound tooth structure is sacrificed. With the conservative access cavity, we can enter the canals at an angulation that is perpendicular to the coronal one-
third of the canal as illustrated in Figure 1b. Moreover, with the aid of pre-bent modern rotary files, which have super-elastic alloys even in their martensitic phase (rest phase), it is possible to enter root canals with difficult access without sustaining fractures.

Only after we have visualised the actual anatomy of the pulp chamber is it possible to precede with root canal shaping, followed by the phases of 3-D cleaning and 3-D obturation. With modern protocols of irrigant activation, it is possible to guarantee a more accurate and thorough cleaning. Among these protocols are ultrasonic activation, sonic activation, internal heating, laser and negative apical pressure.

Why?

Why complicate life? This is one of the most repeated questions when it comes to the conservative access. The answer is simple: because the suggested access design in the current article is not extreme, and when it is performed with experience and with the updated technologies while respecting all of the previously discussed parameters, iatrogenic errors can be avoided. Not only will the tooth be treated in a safe and healthy approach that will preserve valuable tooth structure, but the short- and long-term success will be improved as well. Figures 3–13 illustrate the preparation of a conservative access cavity and its clinical applications in clinical cases.

Conclusion

If through the conservative access cavity, it is possible to eliminate the entire carious lesion, to visualise the whole floor of the pulp chamber, to explore all of the canal orifices, to prepare and to clean the isthmuses, and to remove any calcifications present, then it is possible to obtain short- and long-term success. Above all, valuable sound tooth structure will be preserved in comparison with the conventional access design.

Certainly, in order to prepare these conservative access cavities, it is necessary for the operator to have enough clinical experience. Equally important is the use of modern technologies, in particular the dental operating microscope, ultrasonic tips, modern rotary files and up-to-date protocols of 3-D cleaning. In conclusion, these modern technologies and this conservative access design should be implemented by more endodontists in order to achieve higher rates of success and longevity of root canal therapies.

Editorial note: A list of references is available from the publisher.

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Figs. 12a–d: The four canals after obturation. P = palatal; MB2 = second mesiobuccal; MB = mesiobuccal; DB = distobuccal. Fig. 13: Post-op radiograph.