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Review Article

Effectiveness of microscope in endodontics- A review on visual enhancement of pulp chamber

[1]Indu Kumari, [2]D Krishanamurthy, [3]T Lenin Babu

[2]Prof & HOD, [3]Reader, [1]Department of Conservative Dentistry & Endodontics, Vananchal Dental College & Hospital, Garhwa, Jharkhand, India

ABSTRACT:
The anatomical complexity of root canal system in the context of endodontic therapy is always a challenge. The aim of this study was to systematically review the data available about the use of the operating microscope in endodontics. Literature was searched MEDLINE via PubMed, google scholar, scopus with keywords microscope in endodontics. The selected articles were identified from the titles and abstracts. It was found that microscopeuse has provided Endodontics with a significant improvement in vision of the operative field. Practitioners should be aware of the existence of extra roots and canals and the possible anatomical variations in them before initiating the endodontic treatment. A good visual enlargement of pulp chamber and radiographic interpretation is important for a successful endodontic treatment.
Keywords: Operating microscope; Endodontics; Optical magnification instruments

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Corresponding author: Indu Kumari, Department of Conservative Dentistry & Endodontics, Vananchal Dental College & Hospital, Garhwa, Jharkhand, India

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INTRODUCTION

Visualizing the oral cavity has always been a challenging task for the dentists.[1]The art of dentistry is based on precision.[2] Earlier radiographs were the only way to see inside a root canal, and tactile sensation was used to perform endodontic procedures.[1]The human naked eye is capable of distinguishing fine detail, but it is no match for what can be accomplished when an image is sharpened and enlarged. The microscope and other forms of magnification fill that need, especially for accomplishing endodontic procedures.[2]

Recent developments in dental equipment have improved the clinician's ability to clean, shape, and obturate almost the entire root canal system, thus increasing the quality and the efficiency of root canal treatment. The introduction of magnification devices has resulted in technical changes in the approach to root canal preparation. Along with the development of such devices, the use of magnification and well-focused illumination devices has been recommended to provide the minimum standard of care.[3]The use of optical magnification instruments such as endoscopes, orascopes, loupes and microscopes enables the endodontist to magnify a specified treatment field beyond that perceived by the naked eye.[2]The Operating Microscope (OM) has been used to minimize the obscurity of the operative field favoring better quality results.[4]

MICROSCOPES

HISTORY

Bowles suggested and used a dental microscope as early as 1907. In endodontics, dental operating microscopes were first introduced by individual clinicians and then adopted by endodontic specialty programs throughout the United States.[5]The optical microscope in endodontics was introduced in the early 1990s by Gary Carr,[6] and their study was the basis for several other authors deepen research on its use in Odontology. The American Association of Endodontists (AAE) was an early proponent of training in microscopes for endodontic residents and successfully advocated for the Commission on Dental Accreditation to include a microscope proficiency standard to the CODA educational standards for postgraduate endodontic programs in 1998.[5]Its incorporation in that specialty had profound effects on how to work the endodontist; For this reason, in 1998 the American Dental Association has requested

that all graduate programs in the United States should teach the use of the microscope in nonsurgical and surgical endodontics.[4,7]

DISCUSSION

Nunes E et al[8] presented a case report of a maxillary lateral incisor with advanced perforating internal root resorption in the middle third of the root and the presence of a sinus tract. Mineral Trioxide Aggregate (MTA) was used with the aid of a surgical microscope in order to fill the resorption area after conventional root canal therapy of the apical segment (Visualization of artifact inside the root canal). At the follow-up after 11 years and 8 months, the patient was clinically asymptomatic and the sinus tract had disappeared. The radiographic examination and computerized tomography indicated periodontal bone repair.Cunha RS et al[9] in one of their clinical case, concluded that the high level of magnification and illumination provided by the use of the operating microscope make easy the location of the second canal in the mesiobuccal root of the maxillary molars, as well as the employment of the ultrasonic tips for the removal of small dentin structures which may obstruct the canal orifices. The modification of the surgical access can be of great value for the location and, consequently, for the endodontic treatment success.

Kaneko T et al[10] described a non-surgical endodontic treatment of Oehlers' type III dens invaginatus in a maxillary lateral incisor with the aid of post-obturation cone-beam computed tomography (CBCT). The endodontic treatment was initiated with the aid of a surgical operating microscope, and two canals, one of which represented the invagination, were instrumented, irrigated under passive ultrasonic activation and obturated with the lateral condensation technique. A 14-month follow-up revealed a satisfactory clinical and radiographic outcome, suggesting that the chemomechanical debridement may have sufficed to induce periapical healing. CBCT greatly helped the decision of avoiding further intervention that could have been difficult to negotiate.Karumaran CS et al[11] presented case series where access cavity modification and visual enhancement was carried with operative microscopes. In Case 1, the left maxillary first premolar and the contralateral premolar had type VIII root canal morphology according to Vertucci classification, endodontic access opening was prepared under microscope. The access cavity was modified with a cut at the buccoproximal angle from the entrance of the buccal canals to the cavo surface angle resulting in a cavity with a T-shaped outline. In case 2, operating microscope was used to examine the floor of the cavity and similarly in case 3.

Kontakiotis EG et al[12]demonstrated a rare anatomical complexity in the mesial root of a mandibular first molar. Four independent root canal orifices were found in this root by clinical detection with the aid of a dental operating microscope. This case shows that additional canals can be located in any root undergoing endodontic treatment and clinicians should always be aware of aberrant internal anatomy.Similarly, Kottoor et al[13] observed floor of pulp chamber and root canals location. Sachdeva et al[14] observed floor of pulp chamber and root canals location, Silva EJ et al[15] used to access the pulp chamber, Narayana P et al[16] also used microscope to access the pulp chamber and for placement of intracanal medication.

Hence, operating microscopes combined with careful clinical examination and radiographic interpretation can aid the clinician to successfully treat cases with such internal anatomy. The understanding of this view enables the possible location of additional canals in any tooth requiring endodontic treatment.

USES

The benefits of using magnification devices for conventional endodontic treatment include the increased visualization of the treatment field, enhanced possibilities in locating canals, aid in the removal of separated instruments, diagnosis of root and tooth fractures, perforation repair, and case documentation.[17]Diagnosis of fissure caries, straight line access to the apex of the canal, microfractures,removal of pulpal roof (deroofing), complete exposure of the pulp chamber, location of canal orifices, especially MB2 in the maxillary first molars, dentinal map, bent, split, oval canals, pulp stones/calcifications, obturation techniques, perforation repairs using mineral trioxide aggregate.[18]In retreatment, this device is extremely useful in aiding the removal of posts or fragments of files broken off inside the canal.[19] Furthermore fractures, instrument retrieval, apical ramifications, retreatment, especially gutta-percha removal, and defects or kinks in rotary files, can be traced earlier, thus preventing instrument fractures, access cavity with dentinal map, obturation, instrument fracture n retrieval, laser root canal sterilization, root fracture, root end preparation, periapical surgery.[18]

CONCLUSION

The anatomical complexity of root canal system in the context of endodontic therapy is always a challenge. Clinicians should be aware of the existence of extra roots and canals and the possible anatomical variations in them before initiating the endodontic treatment. The use of supplementary instruments, such as microscopes, computerized tomography can now be rationally used in endodontic treatment. It has been reported that its use has provided endodontics with a significant improvement in vision of the operative field.A good visual enhancement of pulp chamber and radiographic interpretation is important for a successful endodontic treatment.

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