

# Guided Endodontic's in complex scenario like pulp obliteration and root fracture

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**Abstract-** The purpose of this review is to perform overview of an Guided endodontics in complex scenario like pulp obliteration and root fracture which also show the effectiveness of access cavity preparation, minor endodontic surgery, guidance can be obtained by using magnifying glasses, microscopes, and CBCT ,3D Printing, which made an clinician to work more efficient and reduces the chair side process. Guided endodontics is an emerging advanced method for both diagnosis and treatment, which lead a better prognosis for the treatment. Mostly an RCT failure cases, complex anatomy ,minor surgical procedure are indicated for guided endodontics.

**Key words:** Guided Endodontics, pulp obliteration, root fracture ,3D printer.

## INTRODUCTION

Different clinical scenario in endodontics like ,complex anatomy ,calcified canals ,root fracture are over come by digital technique known to be guided endodontics ,where magnifying glasses , microscope and conebeamecomputer tomography can be used for better guidance .HenceGuided endodontics is emerged to solve problems with use of endodontic treatment planning by the help of computer technology better guidance can be obtained by using magnifying glasses, microscopes, and CBCT; however, it can be challenging for the operator especially a novice to interpret the CBCT images, make a mental guide, and carry out the treatment manually all at once. Convention method compromised both the treatment and prognosis of teeth. Due to factors like iatrogenic perforation, fracture, incapacity to remove instrument fragments from within the canal, excessive tooth tissue removal, and inability to locate and negotiate heavily calcified canals. In 2016 ,3 dimensional printed guides or splints emerged ,Author Buchgritz J, Connect T, Krastl G, Zhender MS among others , published first studies with aim of evaluating precision of there system for accessing root canal ,obtaining very satisfactory result. Today ,different types of guided endodontics were emerged ,they are : Static guided endodontics and Dynamic guided <sup>(1)</sup>Lowering of pulp space volume and root canal diameter by apposition of hard tissue (tertiary dentin) along the root canal wall, is a characteristic of pulp canal obliteration <sup>(3)</sup>. Pulp canal calcification can be caused by both systemic and local factors. Common local factors include caries, restorations, excessive forces from trauma and clenching, and cavity preparation. End-stage renal diseases, cardiovascular disease, and certain long-term medications are examples of systemic factors<sup>(2)</sup>. PCO may result in crown discolouration, it is difficult for clinicians to define pulp necrosis after PCO due to lower or negative responses to pulp sensibility tests<sup>(3)</sup>. Complete or partial longitudinal fractures originating from the root, known as vertical root fractures (VRFs), are typically found buccolingually. One of the poor prognosis complications following root canal therapy is VRF, for which the affected tooth or roots are frequently extracted<sup>(4)</sup>. Crown fracture most commonly occurs in permanent dentition, in which 0.5%-7% of root fracture occurs due to trauma.<sup>(5)</sup> Apical root fracture is difficult to treat during periapical surgery, as shown by cone beam CT. Conventional radiography is insufficient in providing information on tooth morphology; guided endodontics uses a 3D print to supplement surface information and an intraoral scan to guide treatment. Reducing chair side time and achieving consistent, safe outcomes are made possible by computer-designed guidelines and treatment plans<sup>(6)</sup>.

**METHODOLOGY:**

Author	Year	Result	Conclusion
Kulinkovych-Levchuk K,	2022	In addition to endodontic cavity access and canal location with PO, guided endodontic applications can also be used for treating teeth with morphological asymmetries, removing fiberglass posts, retrograde fillings, osteotomies, and apicoectomy cases.	Compared to traditional endodontics, SGE is more precise and secure, requires less patient treatment time, and is independent of the operator's experience. DGE is more accurate because it does not accumulate design errors, more ergonomic because it permits real-time adjustment and repositioning of the working instruments, and helpful when dealing with multi-rooted teeth. By this endodontic can be act effectively not only in access cavity preparation and canal location ,also to treatcases like complex anatomy,apicoectomy .
Jiandong B, Yunxiao Z, Zuhua W	2022	From this study the occurrence of PCO is by long term usage of GCs.A diagnose of pulp necrosis was made for these teeth. With the help of an oral microscope, RCT was done inaffected tooth and then a prosthodontic procedure was created for the teeth.	The effects of PNH and other medications cannot be ruled out, based on the patient's long history of GC use and a series of related studies, we conclude that the long-term usage of GCs contributes significantly to the onset of PCO
Dąbrowski W, Puchalska W, Ziemiański A,	2022	An complex cases like PCO was diagnosed and treated by an guided endodontic process then completed by an conventional method	A sophisticated treatment known as guided endodontics helps dentists to treat PCO teeth more precisely and predictably by minimal removal of tissue while access cavity preparation and also possible to shorten the time required to find canals, which enhance digital dentistry.

PradeepKumar AR, Shemesh H, Nivedhitha MS	2021	It was found that CBCT diagnosis of VRF was based on different indicators by evaluating the detection of VRF as a radiolucent/hypo attenuated line crossing the root without continuation of the line into the adjacent tissue.	The available evidence is weak with regard to the diagnostic ability of CBCT imaging to identify VRFs in root-filled teeth compared with direct visualization.
Prithviraj DR, Balla HK, Vashisht R	2014	A rare occurrence, root fractures account for 0.5–7% of traumas to the permanent dentition. They primarily affect the middle third of male patients' upper incisors in their second decade of life and affect the tooth's supporting tissue, dental pulp, and mineralized structures.	The diagnosis and treatment of fractured roots will have an impact on a patient's overall course of care and, consequently, their quality of life. Handling of Vertical fracture
Moreno-Rabié C, Torres A, Lambrechts P	2020	Guided endodontic treatment seems to be a reliable than conventional method when treating calcified canals and anatomical variations or to improve the accuracy of apical surgery	A promising technique that offers a highly predictable result and a reduced risk of iatrogenic damage is guided endodontic procedures. Chairside time can be decreased and minimally invasive treatment can be carried out.
Loureiro MA, Elias MR, Capeletti LR	2020	The results of this study showed that reduction in the volume of dental tissue is similar to conventional endodontic acces in guided endodontic access of mandibular incisors Although the guided access	Less tooth structure loss is encouraged in dental groups with more complex morphology when endodontic access is guided. In mandibular incisors, there was no discernible difference in the amount of dental tissue extracted using guided endodontic access as opposed to conventional methods.

		<p>technique indicated that the group of maxillary molars had more preserved dental tissue, this same technique used to identify the entrance of orifice to the root canals in the molars was able to predictably, and also allowed free access of the endodontic instrument to the root canal system. Therefore, the guides were a viable alternative in planning coronal access, because they were able to detect the entrance orifices to the canals, thus promoting controlled wear of the dental structures.</p>	<p>Nonetheless, more dental tissue was preserved by guided endodontic access in the maxillary molar group.</p>
Su Y, Chen C, Lin C, Lee H, Chen K	2021	<p>Different types of endodontic guiding systems were also introduced, including sleeveless guide system and dynamic navigation system (DNS). The sleeveless guide system uses guiding rails and cylinders attached to the handpiece to guide the direction. This technique requires less space above the occlusal surface and provide better visibility than sleeve template, therefore, it could</p>	<p>The most effective way to differentiate the guided access cavity preparation's canal access ability was through angular deviation.</p>

		be used to solve the problem of the lack of vertical space in molar area.	
Ranka M, Shah J, Youngson C	2012	Immature permanent teeth with root fractures, fractured teeth with no communication between the fracture line and gingival crevice and with minimally displaced coronal fragments have a favourable prognosis	Clinical examination supplemented with radiography and vitality tests is essential for the diagnosis. Appropriate treatment planning with subsequent follow-up is essential for a good prognosis. Sometimes, a multidisciplinary like digital imaging is needed for optimization of the treatment outcome.

**DISCUSSION:**

**ENDODONTIC ACCESS CAVITY:**

The guided access technique revealed that the maxillary molar group had more dental tissue that had been preserved. The endodontic instrument could enter the root canal freely and the molar group’s entrance orifice could be reliably identified using the same technique. Thomas Connert Dr et al conducted an ex vivo study demonstrated that the presented microguided endodontics technique is an accurate, fast, and operator-independent tool for accessing root canals. Mandibular front teeth was used for this study to demonstrate guided endodontics . This was possible because of miniaturized instruments with diameters of only 0.85 mm<sup>(5)</sup>. Guided endodontics was used in clinical research and published in 2015. By acquiring volumetric data through CBCT and surface scan data from an intraoral scanner the actual procedure of guided endodontics is performed . virtual access cavity planning and designing a template is obtained by super-imposed Both volumetric and surface scan data in computer-aided design (CAD) .Afterward, the cavity preparation is executed with drills by manufacturing the template through 3D printing, according to Yinghuo Su et al ex vivo study surface data were saved in the stereolithography and CBCT data were saved in Digital Imaging and Communication in Medicine (DICOM) format<sup>(8)</sup>.

According to Loureiro MAA an alternative capable for providing greater accuracy in endodontic treatment especially in complex scenario is by emerging technique known as Guided endodontic ,Loureiro MA demonstrated an study that volume of tissue removed while access cavity preparation in which he performed 4 groups G1a (conventional method in incisor ), G1b (guided endodontic access), G2a (conventional endodontic access in molar) and G2b (guided endodontic access in molar ), 2CT scan were taken in different points initially scan taken before the operative stage of coronal access, secondly after coronal access . Virtual drawing of guides were performed and overlapped by DICOM and STL, Thus with the guides procedure were performed, as a result of this study the volume of tissue is minimally removed from molars while performing through guided endodontics <sup>(7)</sup>.

**PULP CANAL CALCIFICATION:**

Many factors can lead to the partial or total obliteration of the root canal system (RCS). The pulp of these teeth is at risk of becoming necrotic, necessitating endodontic treatment, which is especially important when there are indications of the onset of apical periodontitis. The remaining canals of severely calcified teeth are localized in the more apical portions of progressively straighter roots, making it difficult to gain access to their entire extension Because this concerns a challenging Stage of endodontic treatment, the localization and negotiation of calcified root canals has been related to an Increase in the rate of technical failures and an unfavourable prognosis, even when the procedures have been performed by experienced professional<sup>(1)</sup>. Pre-clinical studies have reported a high accuracy of the procedure when comparing the drilled path to the planned treatment without being influenced by the operator’s experience. Additionally, the use of a guide for treatment may reduce chair more precisely than in conventional method of treatment <sup>(6)</sup>

## ROOT FRACTURE:

Dental trauma are more common to occur in children ,in adult dental trauma occur by RTA in which root fractures of the teeth are rare to occurs when compared to other forms of dental trauma.Clinically, on presentation, teeth with root fractures indicated by slight extrusion and displacement of that tooth . On examinationof the tooth usually it will be tender to percussion. Discoloration of the crown is seen sometimes a transient red or grey colour changes may occur . If the pulp loses its vitality and becomes infected, it may lead to a sinus tract on the buccal mucosa adjacent to the fracture site. pulp vitality tests can be unpredictable when it carried out immediately after the trauma and sometimes it may sensitive to respons which can be temporarily or permanently due to groups of repair sequelae. Root fracture can be detect by taking more than one radiograph which can be occur by taking diagonal plane and sometimes are not radiographically diagnosed owing to the initiation of healing .However, use of advanced digital imaging, eg Cone Beam CT, may be of added benefit in diagnosis of root fracture .<sup>(9)</sup>

## AN OVERVIEW OF GUIDED ENDODONTICS:

Static guides is mainly used for access cavity preparation and canal location in Guided endodontics .Investigations are in process dynamic navigation in guided endodontic cavity preparation and root canal location .Bone supported surgeries,mucosal surgery and tooth based surgery like apical surgery where performed by Static surgical guides . Eventhough static surgical guides had some drawbacks include that once the planned angulation, size, depth even in implant selection are manufactured, it can't be changed in easily .Other problems include production cost, and time required to plan and to manufacture static guides. In addition, it may not be possible to use static guides in patients with limited mouth opening, or in the second molar regions where access is poorer. By combining two images which contains the CBCT image of the patient upper and lower arch or teeth to be treated and intraoral scanner or impression that scanned .The obtained two images are superimposed by an software aid ,Hence a guide can be designed which will cover the tooth to be treated and some adjacent teeth. Direct access to the calcified canal is than obtained by a guide ,in which a drill hole can be designed this has specifications like appropriate diameter and angulations . To allow the stable and quantified access of a drill to the interior of the root canal through the drill hole cylinders or “sleeves” are designed . The inner cylinder is smaller and is made of metal. The file is exported from the planning software in an STL (stereolithography) format for the 3D printing of the guides once the designs have been completed. Before using the guides, patient preparation is necessary ,rubber dam isolation is carried out and the patient is asked to try the guide to make sure it steadily fit in the teeth .Calcified tissue can be removed by the internal metal cylinder which will guide the drill to access and remove the calcified tissue, and once it is completely removed, the root canal treatment is continued in the conventional manner. CBCT images were used in DGE with reference marks that are placed in the patient's mouth on the side opposite to the side to be operated on (before performing the CBCT). The trajectory of the drills into the pulp chamber and root canal is synchronised in real time with the aid of a stereo camera linked to a dynamic navigation system. This way, the operator can follow everything he/she does on a monitor and can correct or adjust the angulations of the instruments as needed<sup>(1)</sup>.Even though it is more effective and reliable guided endodontic as some limitation specifically in SGE includes duration to design and production of 3D guides, in linear access only works for straight canal ,does not applicable for partially edentulous patients.DGE include ergonomic.<sup>(6)</sup>

## CONCLUSION:

From this A guided endodontics plays an major role in complex scenarios especially in clinicals .An emerging artificial intelligence include guided endodontics ty process this technique is so reliable to attempt which gives a lots of advantages in endodontic like time management, diagnosis, treatment outcomes etc.,Many researchers where held to support the guided endodontics as an effective method than conventional method of treatment.3D scanning ,CBCT, Microscope are the tool which makes an great to get better and make treatment outcomes more justified. Guided Endodontics acts As an heart in cares of complex scenario like complex morphology (curved canal ,Assesssory canals ),pulp obliteration , retrieval of instruments and it plays an major role in periapical surgeries, access cavity ,Thus guided endodontics is an effective method of treatment in complex scenarios.

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