



Guided Endodontics - An Update

Karthika JR^{1*}, Lekshmy S Devi², Lakshmi Aravind³ and Karthik S⁴

¹Post Graduate, Department of Conservative Dentistry and Endodontics,
Sri Sankara Dental College, Varkala, Trivandrum, India

²Professor and Head, Department of Conservative Dentistry and Endodontics,
Sri Sankara Dental College, Varkala, Trivandrum, India

³Professor, Department of Conservative Dentistry and Endodontics, Sri Sankara
Dental College, Varkala, Trivandrum, India

⁴Assistant Professor, Department of Prosthodontics and Crown and Bridge,
Sri Sankara Dental College, Varkala, Trivandrum, India

***Corresponding Author:** Karthika JR, Post Graduate, Department of Conservative
Dentistry and Endodontics, Sri Sankara Dental College, Varkala, Trivandrum, India.

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et al.**

Abstract

The concept of guided endodontics are used for access cavity preparation and Endodontic surgery, in order to achieve safer and predictable results. It offers highly predictable outcome and lower risk of iatrogenic damage. This technique may be a promising method for the endodontic or surgical treatment of complex cases.

Keywords: Static Guided Approach; Dynamic Guiding; Endodontic Guide; Sleeve; 3D Printing

Introduction

The concept of Minimally invasive Endodontics helps to preserve healthy coronal, cervical, and radicular tooth structure during endodontic treatment. It is based on the preservation of pericervical dentin (PCD). In conventional deroofting process, much of the PCD is lost, which reduces the fracture resistance of tooth. Guided endodontics helps in the preservation of PCD and offers the most conservative approach for cases with high difficulty level: calcified canals. The concept of Guided endodontics was introduced with the improvements in tomographic imaging and 3D printing technologies [1,2]. These computer-designed guides are used for access cavity preparation and endodontic surgery in order to achieve predictable and safe results [3,4]. Guided approach

is also gaining popularity in endodontic surgery. 3D printed guide is used for osteotomy and root- end resection [5,6].

Types of guided approach

Guided approach can be static/dynamic. In Static guided approach, the optical impression is merged with the CBCT for the design of a virtual drill path before the clinical procedure. In Dynamic guiding, CBCT data is combined with recordings of drill movement [7].

3D Guide Planning and Designing

- CBCT Scan of involved teeth
- Surface scan
- Merging CBCT Scan and Surface scan.

CBCT and surface scan were matched on radiographically visible structures like teeth of the patient. Software will create the virtual image of commercially available bur. Virtual copy is superimposed with the radiographically visible part of calcified canal. Different softwares are used like coDiagnostiX[®], 2InGIS[®] technology, Aceton[®] Imaging software [8,9].

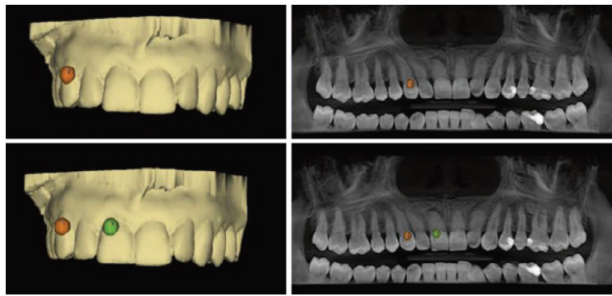


Figure 1: Superimposition of CBCT data and surface scan by marking three spots.

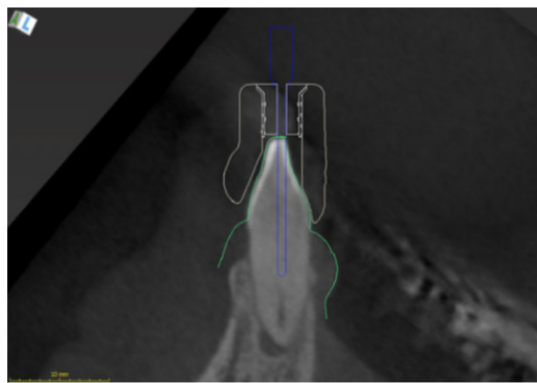


Figure 2: Virtual copy of drill is placed in such a way that the tip touches the radiographically visible part of the calcified root canal.

Endoguide planning

- Tracing the canal
- Sleeve selection.

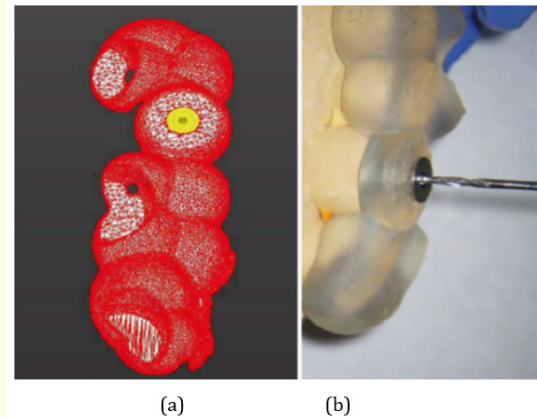


Figure 3: a. Meshwork of endodontic guide. b. Endodontic guide.

Guiding sleeve is added to the scan. The height of the sleeve should be 5-7mm for the endodontic treatment [7].

Documentation

After creating a virtual template by applying designer tool of the software, virtual template will export as a Surface- tessellation-language (STL file) and produced by a 3D printer [10,11].

Clinical procedure

- Correct fit of the template will check on the patient
- Starting point of access preparation on tooth surface is marked with the colored resin
- After removing the guide, the entrance preparation should be done with a high speed bur
- Drilling directly on the dentinal surface with endoguide.

The rotational speed must be set to 10,000 rpm and Microguided endodontic drill will be used to gain an access to the apical third of the root with pumping movements [7].

Guided approach in Surgical endodontics

3D Printed static aids: Applications for endodontic surgery.



Figure 4: Well- fitting template in a correct position.

Pilot guide

Pilot guide is used for the initial drilling and the bony cavity guides the subsequent drills.



Figure 7

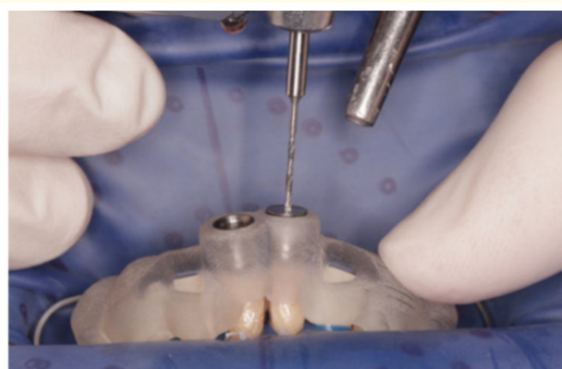


Figure 5: Access is gained to the calcified root canal using Guided endodontic technique.

Full guide for a Bone Trephine

To perform osteotomy and root-end resection simultaneously.

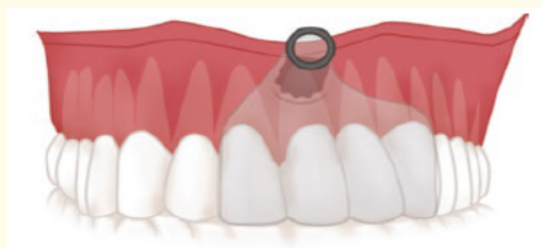


Figure 8: For bone trephine.

Nonguiding 3D printed template

These are designed to define the surgical site [12,13,16].

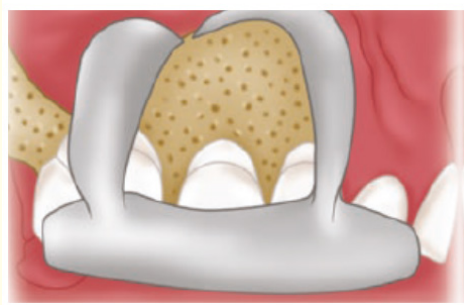


Figure 6: 3D printed endodontic surgical aid for soft tissue retraction [15].

3D printed template for cortical preparation

Helps to assess the exact site for root-end resection.



Figure 9

Advantages of guided approach

- No need to use the Dental operating microscope
- Reduce the time of performing procedure [14].

Drawbacks of guided approach

- Canals with extremely narrow diameters may not be seen in the CBCT images as the voxel size is larger
- Static guide work only for the straight part of root canal
- Presence of metallic restorations/ filling of teeth leads to artifacts on radiograph [17-19].

Conclusion

Guided Endodontics offers safe and predictable method for locating calcified root canals. And it also offers lower risk of iatrogenic damage and it seems to be a highly promising technique. Targeted endodontic microsurgery provides complete and more appropriate root - end resection than traditional endodontic microsurgery.

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