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# Hemisection Procedure Facilitated by 3D Printing and a Customized Surgical Guide: A Novel Approach

**Abstract:** When there is a lesion in a multi-rooted tooth, but only one root is infected, resective therapies are an effective treatment option for maintaining natural tooth structure. Hemisection may be the best line of action when a single root is decayed or periodontally compromised, but the other is intact. As precision and accuracy are paramount in ensuring the success of this procedure, this case explores the integration of 3D printing technology to create a patient-specific surgical guide that demonstrates excellent adaptability and precision during hemisection procedures. The integration of 3D printing technology in hemisection procedures, through the use of a customized surgical guide, offers a promising avenue for precision dentistry. This case report depicts a situation where the distal root of LR6 had extensive bone loss. Hemisection was planned for the tooth using 3D printing and a customized surgical guide to perform the procedure preserving the mesial root.

**CPD/Clinical Relevance:** The use of patient-specific surgical guides, along with CBCT and 3D printing, can enhance the clinical outcome for hemisection.

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Hemisection involves splitting a tooth with two roots (such as mandibular molars or maxillary first premolars) along its longitudinal axis. This procedure is intended to remove one root and a portion of the crown that cannot be saved through endodontic treatment or peri-apical surgery. The remaining root and crown are first treated endodontically before the surgical procedure, and restorative treatment should be performed promptly afterwards to avoid crown fractures.<sup>1</sup>

When periodontal, resorption, perforation, or caries damage is limited to one root and the other root is still largely healthy, this treatment option may be considered.<sup>2</sup>

Hemisection is an alternative therapeutic option to tooth extraction. It demands meticulous planning because its success depends on anatomical peculiarities. Success rates for teeth undergoing hemisection ranges between 56% and 94%, with observation periods of 7–10 years.<sup>3,4</sup>

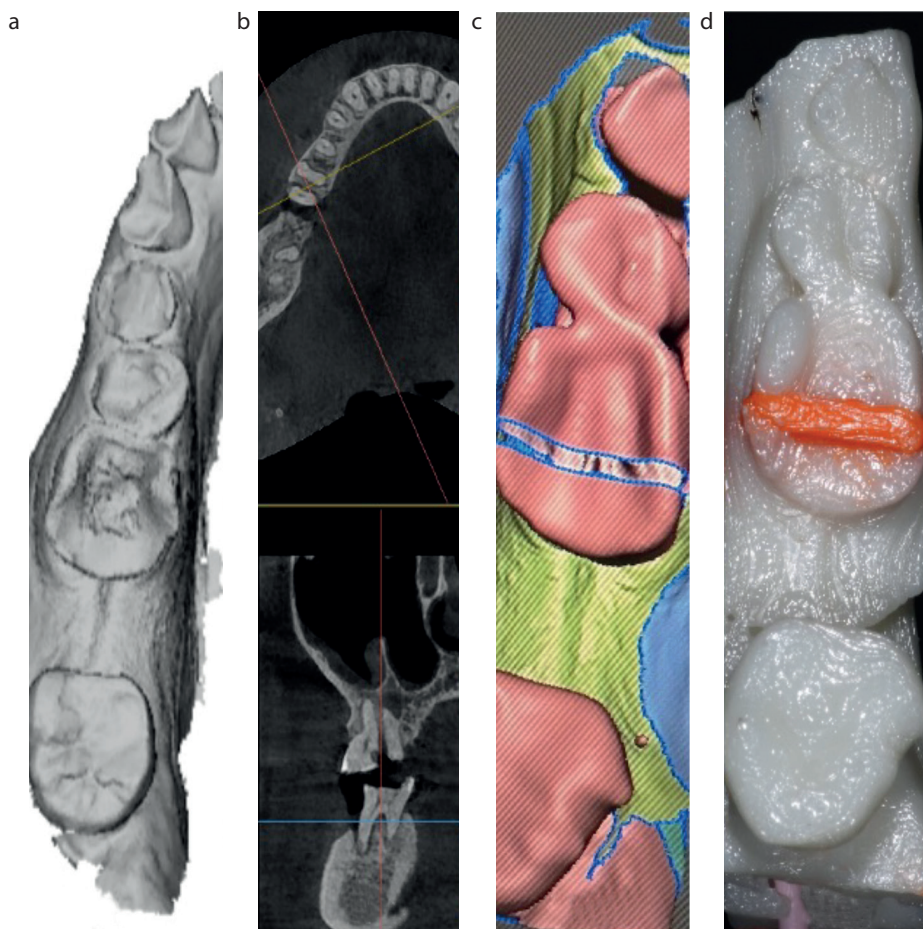
## Conventional technique

In a conventional technique, the treatment is preceded by injecting local anesthesia, after which flap resection at the surgical site is carried out. Then a tentative cut is carried out on the tooth, which is then checked radiographically to give the correct alignment for the bur, after which the procedure is completed.

## Problems encountered during hemisection

- Malpositioning of the bur leading to an inappropriate cut;
- Radiation exposure owing to multiple check radiographs;
- Over-reduction of the remaining tooth structure;
- Time consuming;
- Blind procedure making it technique-sensitive for inexperienced hands.

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**Figure 1.** (a) Digital Impression of the patient. (b) Sectional CBCT of the patient. (c) Digital design of the model to be made. (d) Bone model with slit for hemisection.

To overcome the above-mentioned problems, we developed a guided-hemisection technique, the aim of which was to develop a guide to direct the air rotor head in the bucco-lingual direction in alignment with the necessary cut to be made during hemisection.

### The steps for guided hemisection

- Soft tissue was recorded using a digital scanner (3Shape TRIOS, USA) (Figure 1a).
- A sectional cone beam computed tomograph (CBCT) was acquired for the segment with a limited field of view (FOV) (5 x 7 mm) to limit radiation exposure (Figure 1b).
- The CBCT dicom file was converted to a stereolithography (STL) file, after which the STL file was improved using Blender (Ton Roosendaal, Blender Foundation, Netherlands). Following which, Meshmixer (DGP Lab, University of Toronto) software was used to ready the STL file for 3D printing (Figure 1c).

- The plane of cut was planned digitally using a different colour, with the dimensions similar to the diamond points to be used (TF 11, Mani, Japan).
- Finally, the 3D bone model was printed with Cura (David Braam, Ultimaker, Netherlands)(Figure 1d).

### Steps for making the customized guide

- The hemisection cut was performed on the 3D printed model using a TF 11 diamond point using a high speed handpiece along the plane marked in orange.
- Translational movement of the air rotor head in the bucco-lingual plane was cross checked for any hindrances.
- The cut was analysed under magnification for any changes.
- Cold-cure acrylic was mixed with the recommended powder:liquid ratio and placed on the distal surface of the model in a manner that would allow the placement of the air rotor with bur in the cut (Figure 2a).



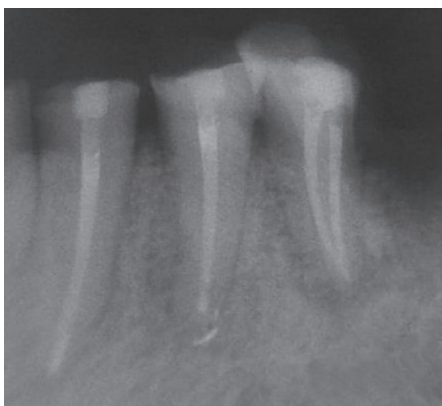
**Figure 2.** (a) Air-rotor head adapting the acrylic in the dough stage. (b) Bone model with acrylic guide. (c) Guide fit intra-orally. (d) Hemisectioning the tooth with the help of the guide. (e) RVG of the hemisectioned tooth. (f) Immediate post-operative image.



- Within the dough stage of cold cure, the air rotor head movement corresponding to the cut made was recorded in the bucco-lingual plane (Figure 2b).

**Clinical procedure**

- The fit check of the acrylic guide was performed before beginning the procedure (Figure 2c).
- 2% Lidocaine local anaesthesia (Lignox 2% A (1:80,000), Indoco Remedies Ltd, Navi Mumbai, India) with adrenalin was administered and a triangular flap was raised.
- To make the cut, the guide was placed in its position, and the air rotor was steered in a buccal to lingual direction, using the guide. During the entire procedure, an intimate contact was maintained between the air rotor head and the acrylic guide (Figure 2d).
- The extent and the accuracy of the cut was checked using radiovisiography (RVG) (Figure 2e) and extraction of the sectioned root and crown was carried out using a Warwick James elevator (Figure 2f), and the follow up was recorded with an intra-oral peri-apical radiograph (Figure 3).



**Figure 3.** Follow up at 4 months.

- Improved emergence profile of the margin;
- Improved predictability of the procedure – it is no longer a blind procedure;
- Difficulty of taking multiple radiographs during the procedure is eliminated;
- A less-experienced clinician could easily perform the procedure predictably;
- Pre-visualization of the procedural difficulties can be seen on the 3D printed model.

**Conclusion**

As precision and accuracy are paramount in ensuring the success of this procedure, this patient-specific surgical guide is a boon for

achieving a successful hemisection procedure. 3D printing and the customized surgical guide show improved outcomes in terms of reduced operative time, minimal invasiveness and preservation of healthy dental structures.

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**Compliance with Ethical Standards**

**Conflict of Interest:** The authors declare that they have no conflict of interest.

**Informed Consent:** Informed consent was obtained from all individual participants included in the article.

**References**

1. Saluja I, Kamath AK, Pradeep S *et al.* Hemisection: partial preservation of compromised tooth. *J Conserv Dent* 2023; **26**: 355–358. [https://doi.org/10.4103/jcd.jcd\\_31\\_23](https://doi.org/10.4103/jcd.jcd_31_23)
2. Ganesan K, Balagangadharan M, Sengoden T *et al.* Hemisection – a challenge for perio-endo lesions: a case report. *J Pharm Bioallied Sci* 2020; **12(Suppl 1)**: S631–S634. [https://doi.org/10.4103/jpbs.JPBS\\_196\\_20](https://doi.org/10.4103/jpbs.JPBS_196_20)
3. Sharma S, Sharma R, Ahad A *et al.* Hemisection as a conservative management of grossly carious permanent mandibular first molar. *J Nat Sci Biol Med* 2018; **9**: 97–99. [https://doi.org/10.4103/jnsbm.JNSBM\\_53\\_17](https://doi.org/10.4103/jnsbm.JNSBM_53_17)
4. Brennan PA, Schliephake HP, Ghali GD, Cascarini L. *Maxillofacial Surgery*. Elsevier, 2016.

**Advantages**

- Accurate alignment of the bur;
- Conservative cut;
- Lesser chance of leaving a dentine lip behind;

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