Guided endodontic treatment of multiple teeth with dentin dysplasia: a case report

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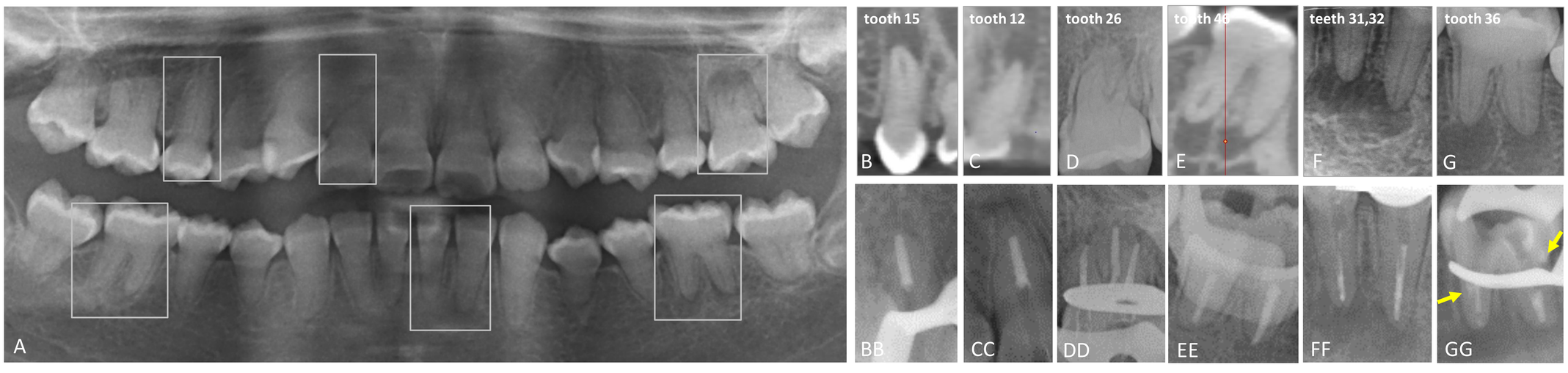
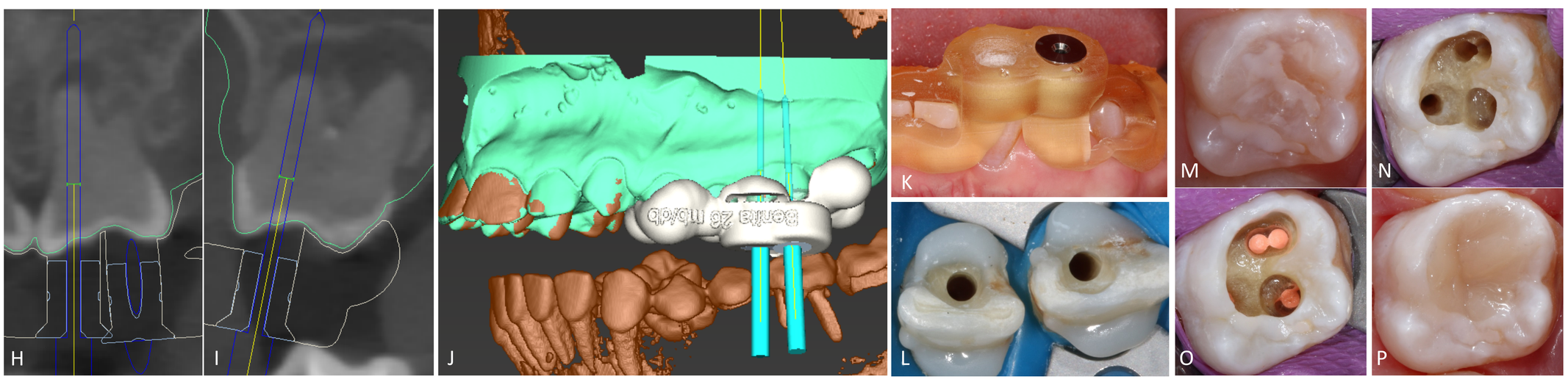
Aim: To report a minimally invasive approach for root canal localization and treatment in a dentin dysplasia patient with pulp canal obliteration and apical periodontitis using a 3D printed template designed by merging cone-beam computed tomography (CBCT) and surface scan data

Case Report: A 14-year old female with radicular dentin dysplasia type I (DD-1), a rare autosomal dominant disorder of dentin formation caused by a dentin sialoprotein coding malfunction, presented for endodontic treatment of seven teeth with apical periodontitis. DD-1 is characterized by teeth with normal enamel but aberrant dentin formation and abnormal pulp morphology. Radiographically, the pulp spaces may be reduced or completely obliterated. Clinically, the patient exhibited acute pain on percussion of tooth 36 and was diagnosed with symptomatic apical periodontitis.



Radiography revealed pulp canal obliteration (PCO) in all teeth showed and apical radiolucency in seven teeth: # 15, 12, 26, 36, 32, 31 and 46 (Fig. A-G). Because of the acute symptoms, #36 was treated first by conventional access preparation and root canal detection. Despite meticulous technique, perforations of the distal and mesiolingual canals occurred and were immediately repaired with mineral trioxide aggregate (ProRoot® MTA, Dentsply Sirona) (Fig. GG, yellow arrows). Consequently, we switched to guided endodontic treatment for the remaining six teeth. CBCT and intraoral surface scans were acquired and matched using virtual endodontic access planning software (coDiagnostiX®, Dental Wings GmbH; see the clinical video: „Guided endodontics: Virtual endodontic access planning using two different workflows"). After the drill position for root canal location was determined (Fig. H, I), a virtual template was designed (Fig. J). The corresponding STL data file was exported to a 3D printer for template fabrication. The template was positioned on the teeth requiring endodontic treatment (Fig. K). A specific drill was used to penetrate the obliterated part of the root canal and obtain minimally invasive access to the apical region (Fig. L, N). All root canals were rapidly and successfully localized. Endodontic therapy consisted of mechanical preparation using nickel-titanium rotary files (Mtwo®, VDW GmbH), sonic-powered irrigant activation with sodium hypochlorite (3%), and vertical warm vertical gutta-percha obturation with AH Plus® (Dentsply Sirona). Down-pack obturation was performed as shown in Figures BB-GG. Access cavities were then restored with composite fillings (Fig. O, P).



Discussion: Unlike conventional endodontics, which resulted in dual perforation of tooth #36, guided endodontics (GE) achieved safe root canal localization in all teeth (#15, 12, 26, 32, 31, and 46) without complications. *Ex-vivo* study results are promising, showing that GE is a highly precise and time-saving technique of root canal localization.[1-3] After merging pre- and postoperative CBCT scans, the investigators found that angle deviation between the virtual planning axis and the actual axis of root canal access was a mean of 1.8 degrees, and that the mean deviation from the virtual target endpoint (irrespective of operator) was 0.2 - 0.5 mm in different axes. The mean treatment time for GE (sum of all steps including planning and preparation) was ≤ 10 minutes per tooth.[4] Connert and colleagues compared tooth substance loss in 3D printed teeth with PCO treated by microguided versus conventional endodontics (dental microscope) and found that microguided endodontics located significantly more root canals with less substance loss.[5] Other investigators report that this approach is clinically useful for facilitating the root canal treatment of anterior and posterior teeth with PCO and apical periodontitis.[4,6]

Conclusion & Clinical Relevance: Guided endodontics is shown to be a safe and clinically feasible method to locate root canals and prevent root perforation in teeth with PCO and apical periodontitis. Generally, this technique is mainly used in teeth with post-traumatic PCO, but it may also have substantial clinical benefits for patients with tooth obliteration due to rare disorders of dentin development (e.g., dentin dysplasia) who are in need of endodontic treatment.

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