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CASE REPORT

TRACTION OF IMPACTED CANINE WITH A SURGICAL TEMPLATE PERFORMED VIA A DIGITAL WORKFLOW

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Abstract

Objective: Traction of the impacted canine can be a very traumatic operation. Not only the transoperative phase, but also damage to the neighboring tooth can traumatize patients. The main objective of this paper is to report on the use of a three-dimensional (3D) printed guide planned virtually to allow the installation of an orthodontic appliance with minimal trauma to the surrounding soft and hard tissues.

Methods: The methodology of the CARE guidelines was followed in the presentation of this technique presentation. A 22-year-old patient was subjected to an impacted canine traction using a 3D-printed surgical template. In addition to being effective in achieving a perfect traction vector, the neighboring tooth was preserved.

Results: A printed guide is of great importance in reducing postoperative effects and operating time. Using a digital workflow can greatly aid traction on the affected teeth. Avoiding trauma to the neighboring tooth enables suitable traction, keeping the area of a bone or conjunctive tissue graft away. A digital workflow in creating a printed guide for these situations is suitable. While not a fast technique, advances in technology may soon reduce the time.

Conclusion: Digital workflow planning and template printing is helpful in tooth traction, avoiding interferences and decreasing time of orthodontic treatment.

Keywords: 3D printing technology, Cone-beam Computed Tomography, Diagnostic Imaging, Impacted Teeth, Orthodontic Traction.

INTRODUCTION

Dental tractions could be very traumatic for

patients and a challenge for professionals.¹ The traditional approach with mucoperiosteal elevation of the hard palate leads to a non-mild postoperative phase

and leads to constant patient complaints. Surgery can produce the worst post-operative results when traction involves two or more teeth due to a larger access. Another important issue about tooth traction is the spacing of neighboring teeth, which can result in physical damage or resorption at root,² resulting in tooth loss.

The digital workflow with virtual planning and 3D printing is becoming more and more important in dentistry. Some advanced tools make some procedures more precise and easier to use such as orthognathic surgery and dental implants. The role of interventions with digital workflow is steadily increasing and is not restrict to oral and maxillofacial surgery or implantology. Orthodontics,³ Periodontics,⁴ Endodontics,⁵ Restorative Dentistry,⁶ and Prosthesis⁷ benefit from digital planning and printing. A digital workflow could avoid more aggressive techniques like autotransplantation.⁸

This article describes a novel method for guided traction of impacted teeth. A 3D template was created

to help locate the affected teeth, which was useful during surgery time. The traction vector was assessed and improved to avoid damage to the adjacent tooth root.

CLINICAL CASE REPORT

The methodology of the CAREL guideline⁹ was followed in the presentation of this technical note. To the knowledge of the authors, there is no report on digital planning and printing of an oral guide to aid in dental traction.

A 22-year-old female patient was referred by an orthodontist to examine two impacted upper canines (Figure 1). Both upper canines could be observed through a panoramic x-ray, but clinical examination failed to assess both tooth positions. Digital tomography was performed to plan an implant surgery (Figure 2).

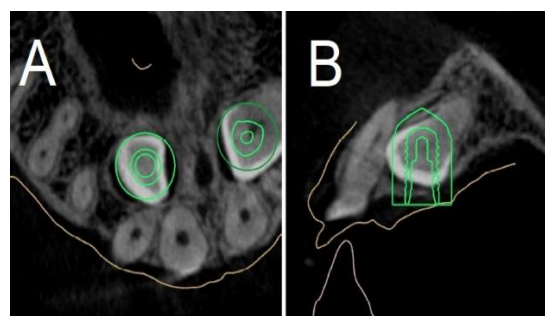


Figure 2. Clinical view at left. Three-dimensional tomography and implant simulation over the included tooth in an axial view (A) and sagittal view (B)

An implant simulation was superimposed on both canines and a collision map was created (Figure 3). Using this digital tomography, a 3D template with two holes was planned and printed to design the surgical access more precisely. The direction of the holes was planned and positioned to facilitate traction (Figure 4).

The goal was the coronal area, due to the higher adhesion of resin and enamel, to avoid root cement. The access operation was performed with 3D guidance in place (Figure 5). A thermocautery was used to cut and remove soft tissue over both teeth without bleeding.

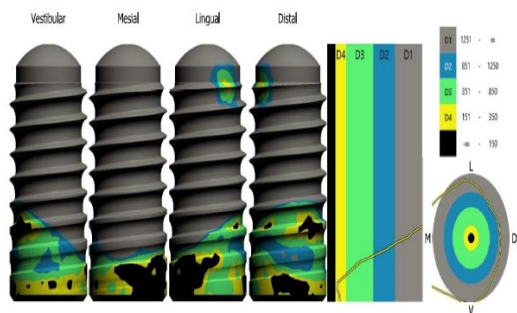


Figure 3. Generated collision map that simulates a collision between the included and exposed tooth. The color legend shows the bone density from harder (D1) to smoother (D4)

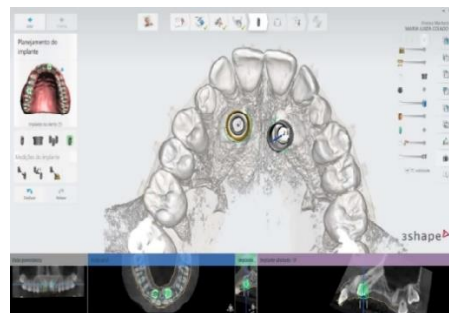


Figure 4. 3D printed template on planning software. Note the different slope axes of the holes



Figure 5. Planning the slope of the holes, facilitates traction, safer procedure for the neighboring tooth

The orthodontic appliance was placed on the same day. Both canines were assessed orthodontically and pulled in the distal/vestibular direction to avoid damage to neighboring tooth (Figure 6). After four weeks both teeth were in a different position. If

necessary, a new orthodontic appliance could be fitted for better alignment (Figure 7).

This second adhesive can achieve an ideal tooth position with a more efficient mechanical strength.

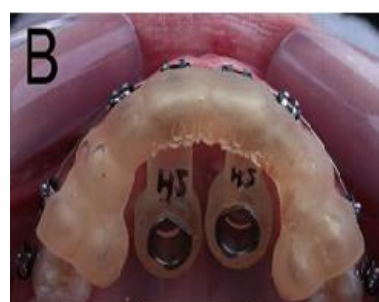


Figure 6. Printed template in position. Frontal view (A) and palatal view (B)



Figure 7. Upper canines' exposition after four weeks, frontal view (A) and palatal view (B). A bracket was attached to left upper canine

DISCUSSION

With some options, traction of an impacted canine can be performed. Orthodontic extrusion is considered a safe and efficient method, although it is not effective in all situations. In a few cases, around 10%, a transalveolar transplantation is required.¹⁰ A difficult step in orthodontic extrusion is the installation of the orthodontic appliance. Due to the humid environment and surgical approach, the orthodontic appliance installation may need to be performed multiple times until a success is achieved.

Another obstacle to traction of the impacted canine is the traction axis. Due to the minimal surgical access, in some cases it is very difficult or even impossible to achieve an adequate traction axis. This feature can cause an unintentional pull axis, which leads to resorption of the neighboring tooth root.¹¹

A digital workflow can solve both problems. A digitally printed 3D template can be done to avoid these problems. Digital planning makes it possible to choose an adequate traction axis and avoid root resorption. Due to the precise surgical access provided by this 3D template, the installation of the orthodontic device follows exactly the planned pull axis. A collision map enables any obstacle to be visualized during traction. The digital workflow also enables the orthodontic device to be changed.

With a tiny surgical approach, less bleeding, and a complete exposure of the tooth area where the orthodontic appliance must be installed is possible. This step keeps the area dry, which allows the orthodontic appliance to be installed in the same surgical time. Using a thermocautery is helpful in achieving a dry area. With open surgical accesses, thermocautery may not be as efficient as it would be with tiny accesses.

One limitation of this study is the inability to use a tooth template instead of an implant template.

Software must be updated to enable this capability and to perform more precise surgical planning and printing of template. Soon, a digital workflow might even make it possible to even achieve the chance of traction or removal and offer patients the chance with safer options. Patients might choose the option that is more comfortable depending on the exact chance of one procedure or the other.

CONCLUSIONS

A 3D-printed template is very useful in tooth traction and enables faster and safer surgery than the traditional approach with fewer complications. Damage to the adjacent tooth root can be completely avoided with the digital workflow by choosing the appropriate pull axis.

DECLARATIONS

Conflicts of interest and financial disclosures

The author declares that he has no conflict percent and there was no external source of funding for the research in question.

Ethical approval

The study was approved by the Institutional Ethics Committee and was conducted in accordance with the Declaration of the World Medical Association.

Informed consent

Informed consent was obtained from all individual participants included in the study.

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