

Erbium Laser Treatment Of An Impacted First Mandibular Premolar: A Case Report

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Dental impaction defines a tooth that, instead of erupting to occupy its functional position, is partially or totally retained and remains within the bone. Retained teeth can be placed in the normal arch position through a combination of orthodontics and conventional surgical techniques, or a combination of orthodontics and laser surgery, as in the case here presented of a 14-year-old boy with an impacted first mandibular premolar, covered by bone, and with complete root formation and an erupted second premolar. The impacted premolar was surgically exposed using an Er,Cr:YSGG laser and at the same time an orthodontic bracket was bonded to provide traction to move the first premolar into its arch position.

Keywords: dental impaction, premolar impaction, laser pediatric dentistry, erbium laser

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INTRODUCTION

Teeth can be classified as erupted in the arch, in physiological process of eruption, or impacted teeth. Impacted teeth can be further divided into totally or partially retained.

Dental impaction defines a tooth that, instead of erupting to occupy its functional position, is partially or totally retained and remains within the bone.¹ A totally impacted tooth is retained in the maxilla or the mandible, surrounded by the pericoronal sac and with the overlying bone intact. A partially impacted tooth, on the other hand, has perforated through the overlying bone, whether opening the pericoronal sac or not, and it can appear in the mouth or remain under the mucosa.²

There are different etiological causes of dental impaction, such as: an obstructed eruption path by the presence of supernumerary teeth,^{3,4} dentigerous cysts and other odonto-

genic tumors,⁵ ectopic position of tooth buds,⁶ trauma-induced ankylosis of the tooth bud,⁶ premature loss of primary teeth with loss of space,⁷ major syndromes,⁸ systemic diseases,⁸ hereditary factors⁸ and idiopathic causes.⁹

In contrast, failure to erupt occurs when the tooth's eruption is delayed by more than two standard deviations from the corresponding mean for that tooth,¹⁰ without there being any reason or calcified obstacle impeding its eruption.¹¹ Reports have been published indicating the existence of pericoronal mixofibrous hyperplasia, in the gingival tissue removed during treatment, in cases of tooth eruption failure.^{11,12} With this in mind, Taguchi¹³ and Watanabe¹⁴ suggested that pericoronal mixofibrous hyperplasia might induce alterations in eruption.

If dental impaction is asymptomatic, it is diagnosed during a routine clinical examination with the pertinent radiographic study.¹⁵ In all symptomatic cases the consequences are the same; it may cause root resorption of the neighboring teeth, repeated infectious processes, the formation of dentigerous cysts, different types of pain and multiple misalignment, with the corresponding esthetic and functional problems.^{2,4} In these cases, swift action is necessary to correct the problem.

Treatment of impacted teeth will vary according to the tooth being affected and specific circumstances. A number of these teeth can be maintained and treated with a conservative combination of surgery and orthodontics in order to be positioned and aligned into the dental arch. However, if conservative treatment is ruled out, the tooth should be surgically extracted as soon as possible.^{2,16}

This article reports the case of an impacted mandibular first premolar, surgically treated using an Er,Cr:YSGG laser (Waterlase®, BIOLASE Tech, Inc. San Clemente, CA) and later subjected to orthodontic treatment to position it in the dental arch. The crystals in the Er,Cr:YSGG laser are

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Figure 1. Diagnostic panoramic radiograph. A totally impacted left first mandibular premolar with complete root formation can be observed.

Yttrium, Scandium, Gallium and Garnet. The crystal matrix contains Erbium and Chromium as dopants. The Waterlase® is a hydrokinetic system with a 2780 nm wavelength. The cutting system is based on photon liberation in an air-water spray. The energy is carried by a fiber optic system to the laser tip made of sapphire crystal. It cuts both soft and hard tissues.^{17,18}

CASE REPORT

A 14-year-old male adolescent under orthodontic treatment visited the pediatric dental clinic of the Dental School of the University of Barcelona because a first mandibular premolar had failed to erupt. His medical history was non-contributory.

At 9 years of age, the ankylosed and infraoccluded primary mandibular left first molar had been extracted. The absence of the mandibular left first premolar was noticed during the intraoral examination and the radiographic examination revealed a totally asymptomatic dental retention with no apparent cause (Fig. 1).

The surgical area was anesthetized using 48 mg of 2% lidocaine with epinephrine 1:100,000 with a mandibular block and buccal infiltration. The incision was performed using the Er, Cr: YSGG laser, eliminating the mucosa and the bone overlying the tooth, and accidentally producing impacts on the premolar's buccal enamel (Figs. 2 and 3). The laser settings were those recommended by the manufacturer for hard (5.50 watts, 75% water, 90% air) and soft tissues (1.50 watts, 10% water, 11% air). During the same surgical intervention an orthodontic bracket was bonded to the retained tooth (Fig. 4).

The post-operative period was uneventful; neither analgesic nor anti-inflammatory medication was required. The tissue's appearance 24 hours after the surgery was very satisfactory (Fig. 5). Slight hyperemia was observed at the edges of the wound with very slight signs of inflammation. One year later, the premolar had reached a normal position in the arch (Fig. 6).

DISCUSSION

As the literature review revealed, there are many causes associated with dental impaction, including: mechanical impediment due to the presence of supernumerary teeth, an



Figure 2. Laser osteotomy exposing the premolar is performed with water irrigation through the laser handpiece

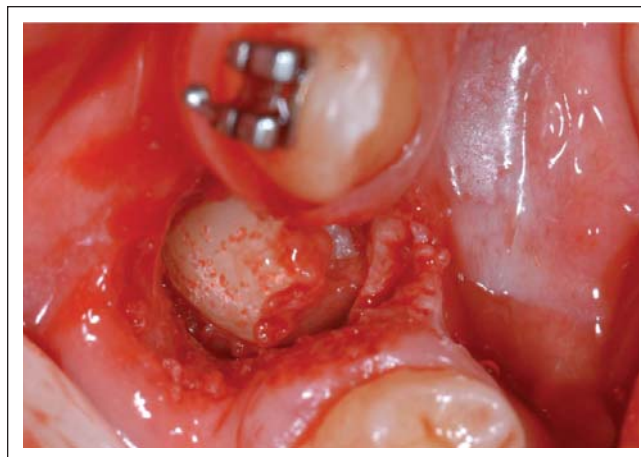


Figure 3. Laser impacts on the buccal surface of the premolar.

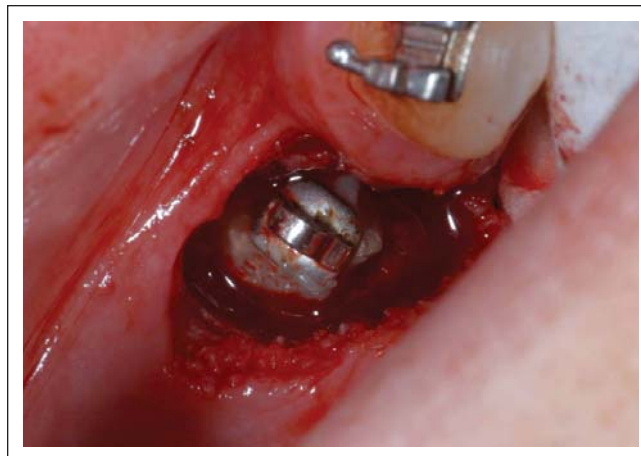


Figure 4. Orthodontic bracket bonded at the end of the surgical procedure.

odontogenic tumor or cyst, or a lack of space in the dental arches. Furthermore, dental eruption can fail in cases associated with disorders related to the head and neck (cleidocranial dysostosis), genetic or endocrine disorders (hypothyroidism and hypopituitarism).⁴



Figure 5. Healing process 24 hrs after surgery. Little inflammation can be appreciated



Figure 6. One year later, the premolar has reached normal position in the arch.

In the case here reported, we believe that the origin of the premolar impaction was caused by the retention of the first primary molar. The latter was extracted because it was ankylosed and in infraocclusion. It is possible that both, the post-extraction alveolar bone healing and the formation of pericoronal mixofibrous hyperplasia impeded the eruption of the impacted tooth.

Several authors suggest the following order of frequency of occurrence for dental impaction (not including third molars): maxillary canines, second mandibular premolars, mandibular canines, supernumerary teeth, maxillary incisors and primary teeth, mainly molars;^{19,20} the case here presented, is therefore not among the most frequent.

The most common complications of impacted teeth are: root resorption of the neighboring teeth; infection and associated pain; and a predisposition to external resorption and to the formation of cysts on the retained tooth.²⁷ In this case, there was no resorption of the neighboring teeth nor reports of pain or inflammation.

The treatment of impacted teeth varies according to the tooth affected and the specific circumstances; if viable, the tooth's position in the arch should be corrected orthodontically.^{16,21}

Treatment using the erbium laser marks a difference from surgical flap procedures in that it involves a reduction in the amount of local anesthetic and the duration of intervention, it produces a hemostatic effect that enhances visibility of the area, it eliminates the need to suture, and it reduces the post-operative edema and pain.^{22,23} The patient's wounds healed fast without post-operative problems or need for analgesic medication. For the case presented, of the multiple advantages cited, the hemostatic effect was particularly important

since it allowed for an orthodontic bracket to be bonded on the buccal side of the premolar, thus providing the ability to apply immediate traction force.

The Er,Cr:YSGG laser allows for precise surgical ablation with minimal thermal damage to adjacent tissues *in vivo*. The overall subsequent healing is favorable and we conclude that this laser may be used in oral surgery.²⁴ Small scratched areas of dehydration were accidentally produced on the buccal surface of the premolar while performing the surgery. Ideally this should be avoided. The depth of the impacts was small and did not alter the anatomy of the enamel prisms.^{25,26} The enamel surface resembled enamel etched with phosphoric acid. It does not take long for the tooth structure to rehydrate.²⁵ Lasers are a considerable aid in pediatric dentistry even though their use is still not widespread. The fact that erbium lasers are the most versatile, since they can be used for both, hard and soft tissues, will help to gain acceptance amongst pediatric dentists.²⁴

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