

Laser surgical approach to impacted maxillary incisors: case series and brief review

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Abstract. – **OBJECTIVE:** Report Authors' clinical experience on impacted maxillary incisors treatment with laser technology.

PATIENTS AND METHODS: Studied population was composed by 6 male and 12 female undergoing orthodontic treatments for lack of eruption of 28 upper incisors; eight impacted teeth (4 patients) spontaneously erupted after orthodontic creation of the correct eruptive space. Twenty maxillary incisors were surgically exposed; in 5 patients seven un-erupted incisors were exposed through an apically positioned flap technique; in two patients a guided closed eruption technique was performed on a central and two lateral maxillary incisors; in seven patients laser exposure technique was applied on ten incisors. All impacted teeth resulted correctly aligned at the end of therapy.

RESULTS: Impaction of incisors is not a frequent event in dental practice. The positioning of the incisors was obtained by creating the eruptive space and aligning the un-erupted teeth with orthodontic treatment or after removing any obstacle or after their exposure with different surgical methods. In all patients the treatment allowed the restoration of both the aesthetic and function aspect of the stomatognathic apparatus.

CONCLUSIONS: In this case series, patients undergoing exposure of the dental crown using diode laser showed the best postoperative course.

Key Words:

Impacted maxillary incisor, Orthodontic-surgical treatment, Diode laser.

Introduction

Impaction is a clinical condition characterized by absence of teeth in the arch after usual time of eruption¹⁻⁴. It is twice as common in women and it can occur with any tooth; the

maxillary permanent incisors are not frequently involved⁴⁻⁶; in fact they resulted un-erupted in 0.2-1% of population, less frequently than third molar or canine tooth^{2,4,5}.

The impaction of incisors is often suspected by parents^{3,4}: clinical signs are retention of the primary teeth and no eruption of permanent teeth, asymmetric eruption of teeth with deviation of the inter-incisive line, closure of eruptive space, swelling of alveolar mucosa and gingival tissue^{2,4,7}.

Several factors can cause impaction of maxillary incisors, e.g., obstacles such as supernumerary teeth, cysts, tumors, odontomas, over-retained with root *ankilosis* or early lost with dense mucoperiosteum of primary teeth, or trauma to primary teeth that determine dilacerations or displacement of dental germs, ectopic development, agenesis, and abnormal morphology of permanent teeth and lack of space^{1,3,4,6,8}.

In the case of un-erupted incisors accurate diagnosis and setting up an appropriate treatment plan are crucial. A clinical intra-oral examination should be conducted to identify any obstacles to eruption, the rotation and inclination of the adjacent teeth, vestibular or palatal swelling and bulge in the buccal sulcus at 1-1.5 years after the expected time of tooth eruption, finally the availability of suitable eruptive space^{2-4,7}.

Imaging exams are important aids in the diagnosis and location of impacted tooth. In particular, periapical, occlusal and panoramic radiograph are widely used^{3,4,7,9}.

Nowadays the method of choice for a precise position identification of an un-erupted tooth is the Three-Dimensional Computed Tomogra-

phy (3D-CT)^{3,4,10}. Recently Cone-Beam Computed Tomography (CBCT) has been introduced in clinical practice: this device represents a radical change in dental and maxillofacial radiology as it offers the potential for improved diagnosis with better resolution and lower exposure to radiation, compared to conventional CT. CBCT scanning produces high-resolution images fundamental for the accurate diagnosis of impacted teeth, their precise location and orientation, the labial and palatal bone thickness, an eventual root resorption of adjacent teeth, the identification of any possible associated complications and consequently for the best treatment planning^{4,10-13}.

As soon as a definite diagnosis of impaction has been reached, the treatment of un-erupted maxillary incisors teeth requires concomitant multidisciplinary approaches to obtain satisfactory aesthetic and functional results^{2-6,8,14-16}.

The simplest treatment provides for the removal of any physical obstacle to eruption. Sometimes after elimination of primary incisors or other obstacles the permanent teeth erupt spontaneously^{2,4,14}; in other cases, an orthodontic treatment is necessary to create space: the eruption of impacted tooth can be facilitated by palatal expansion and often, after increasing the dental arch length, is possible, in 54-74% of cases, to observe the eruption^{2-5,8,14}.

In many cases a surgical exposure is needed using different treatment options: apically repositioned flap technique or closed eruption surgical technique; in both cases traction and orthodontic alignment in the arch of the impacted tooth is necessary^{3,4,5,15-17}.

The laser use is getting an increasing importance in oral surgery as the lack of bleeding represents a clear advantage: often this new technique represents an indispensable completion of many surgical orthodontic procedures¹⁸⁻²⁰.

In this retrospective study is reported our clinical case series of patients treated for un-erupted maxillary incisors.

Patients and Methods

The studied population included eighteen patients (6 males and 12 females), with age ranging from 8.08 to 16.16 years. Patients underwent orthodontic therapy for twenty-eight impacted maxillary incisors, 13 centrals and 15 laterals (Table I). All patients had unremarkable medical history, un-erupted central or lateral inci-

sors, pre-treatment and post-treatment study casts and in all cases orthodontic therapy was performed to create the eruptive space. Written informed consent was obtained from patients' parents and tutors for publication of this case report and any accompanying images. For case reports our local Ethic Committee only asks the patient's written informed consent in accordance with the ethical standards of the Helsinki Declaration of 1964.

Results

Nine patients (C.N., D.J.S., F.F., Z.T., A.E., B.M., F.M., N.N., Z.C.) presented over-retained primary central or lateral incisors; among these, one female (F.M.) also presented one supernumerary tooth. In all patients any physical obstacle to eruption was removed. Nine patients (B.A., M.F., C.E., C.H., M.V., C.R., N.C., C.L., G.N.) presented too early loss of primary central or lateral incisors, and two of them (C.E., C.H.) also a supernumerary tooth.

Four patients (C.N., F.F., A.E., Z.C.) had a spontaneous eruption after creation of eruptive space and extraction of eight primary, central or lateral, incisors.

Twenty maxillary incisors were surgically exposed. In all cases the space was obtained and the teeth were aligned with fixed orthodontic therapy.

In five patients (Z.T., C.E., C.H., C.L., G.N.) seven un-erupted incisors were exposed through an apically positioned flap technique. This technique involved a split thickness pedicle flap reflected from the edentulous area, extended vertically into the vestibule. In two patients (C.E., C.H.), after orthodontic creation of the eruptive space, a supernumerary tooth extraction was simultaneously made during exposure of the un-erupted tooth (C.E., Figure 1). In one patient (G.N.) the first right bicuspid was extracted to obtain a correct alignment of the teeth (G.N., Figure 2).

In seven patients (B.A., M.F., M.V., B.M., C.R., N.C., N.N.) the exposure of the crown of ten permanent incisors was made using a 980 nm diode laser GIOTTO 7 WATT, Dental Medical Technologies (DMT Srl, Lissone, MB, Italy). In all cases two thirds of the crown were uncovered and a bracket was immediately bonded on it and connected to the orthodontic arch in order to correctly align the tooth (B.A., Figure 3).

In two patients (D.J.S., F.M.) the closed eruption technique was performed: a flap was created to

Table I. Eight-teen patients, 6 males and 12 females with age ranging from 8.08 to 16.16 years, underwent orthodontic therapy for twenty-eight, 13 centrals and 15 laterals, impacted maxillary incisors.

N	Identification code/age aa.mm	Gender	Impacted tooth, side	Primary tooth early lost	Over retained primary	Extraction primary tooth	Supernumerary tooth extraction	Orthodontic creation of eruptive space and alignment	Spontaneous eruption	LASER exposition of impacted tooth	Apically repositioned flap technique	Closed eruption technique
1	B.A. 09.07	male	2.2 v; 1.2 v	YES				YES		YES		
2	M.F. 13.09	female	2.2 v, conoid	YES				YES		YES		
3	C.N. 10.06	female	2.1 v, 2.2 v		YES	YES		YES	YES			
4	D.J.S 16.02	male	2.1 v, 2.2 v		YES	YES						YES
5	F.F. 08.10	female	1.2 v; 1.1 v, 2.1 v, 2.2 v		YES	YES		YES	YES			
6	Z.T. 11.11	female	1.1 v, 1.2 v		YES	YES		YES			YES	
7	C.E. 15.10	female	2.1 v		YES	YES	YES	YES			YES	
8	C.H. 11.02	female	2.1 v	YES			YES	YES			YES	
9	M.V. 10.05	male	1.2	YES				YES		YES		
10	A.E. 09.06	female	1.1		YES	YES		YES	YES			
11	B.M. 10.01	female	2.1 v, 2.2 v		YES	YES		YES		YES		
12	C.R. 09.11	male	1.2 v, 2.2 v	YES				YES		YES		
13	N.C. 09.01	male	1.1 v	YES				YES		YES		
14	C.L. 13.07	female	1.2 v, 2.2 v	YES				YES			YES	
15	F.M. 14.05	female	2.2 v		YES	YES	YES	YES				YES
16	G.N. 12.01	male	2.1 v	YES				YES			YES	
17	N.N. 11.00	female	1.1 v		YES	YES		YES		YES		
18	Z.C. 09.04	female	2.1		YES	YES		YES	YES			
		6 male 12 female	13 central, 15 lateral	8 patients	10 patients	10 patients	3 patients	18 patients	4 patients	7 patients	5 patients	2 patients

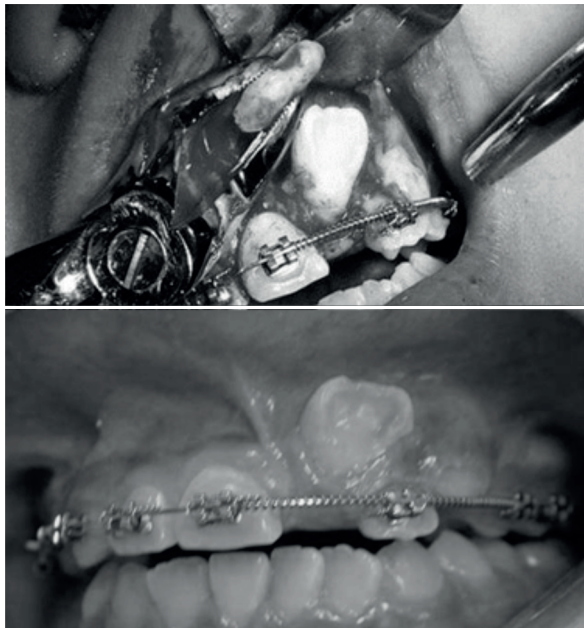


Figure 1. C.E. Orthodontic creation of the eruptive space and supernumerary tooth extraction.

expose the crown of the un-erupted incisors and a button was bonded with a ligature wire on it. Later the flap was closed and sutured, leaving a ligature wire with a hook end, protruding through the mucosa. The hook was then connected to the orthodontic arch by an elastomeric chain. Finally, when the crown erupted out of gingiva, a standard incisor bracket was bonded in order to properly position the tooth in the arch (D.J.S., Figure 4).

Follow up analysis showed that patients undergoing closed eruption technique experienced pain and swelling for a longer period after surgery compared to patients undergoing exposure of the dental crown using the laser.

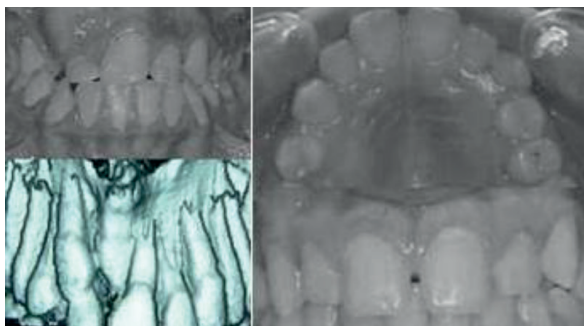


Figure 2. G.N. Early loss of primary first incisor and failure of eruption of right first maxillary incisors and cuspid; first right bicuspid was extracted to obtain a correct alignment of the teeth.

Discussion

Impaction is a pathological condition defined as the lack of eruption in the oral cavity of a permanent tooth and its retention in the maxillary bones^{1,3}.

When the incisors do not erupt at the expected time and an impaction is diagnosed, it is necessary to bring the un-erupted incisor into its correct position using surgical-orthodontic treatment because no prosthetic solution is better than the tooth itself, as the volume of alveolar bone is preserved^{3-5,14-17}.

Several factors could cause the failure of a correct guided eruption of the impacted incisors, such as their excessive proximity to the adjacent teeth in the dental arch, the overlap of the crown on the roots, a great distance from the occlusal plane, ankylosis, and abnormal morphology of the crown^{3-5,7,15-17}.

Repositioning of an impacted tooth involves risks of necrosis, root resorption, injury to adjacent teeth, alveolar bone loss, gingival recession, increase in clinical crown length, esthetic problems and tooth loss^{2-5,15-17}.

The most commonly performed therapies are the removal of obstacles to eruption (i.e., primary or supernumerary teeth), orthodontic creation of the eruptive space, surgical exposure, traction and alignment of the impacted tooth in the arch. The treatment ensures favorable outcomes, obtaining aesthetic and functional result^{2-5,14-17}.

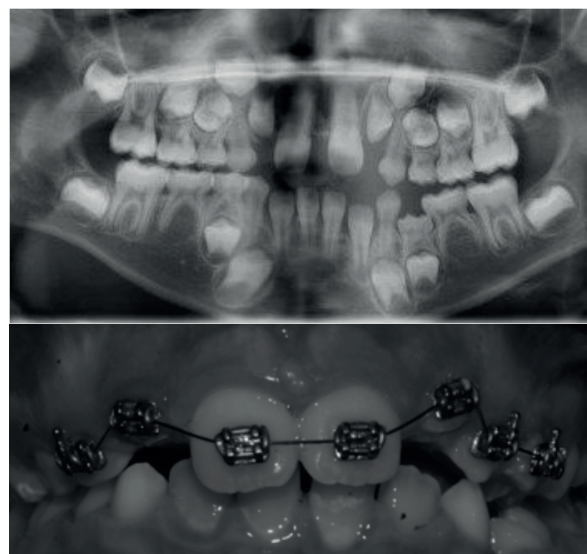


Figure 3. B.A. Laser surgical exposure and immediate positioning of orthodontic brackets on lateral incisors.

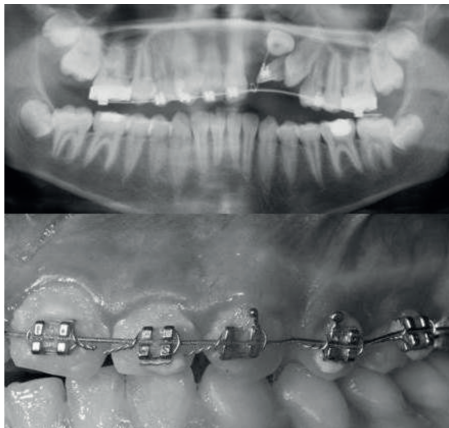


Figure 4. D.J.S. Final orthodontic alignment of the unerupted teeth.

Today in dental practice the use of diode laser, characterized by 980 nm radiation wavelengths, is very common in soft tissue surgery¹⁸⁻²¹ and orthodontic procedures²².

When the impacted tooth is not deeply retained, and the surgical exposure of the crown allows the conservation of the attached gingiva, diode laser approach represents an advantageous solution. In fact, it allows not only the lack of bleeding during surgery, but also it avoids or reduces the use of analgesic and anti-inflammatory drugs, assuring minimal postoperative complications and the possibility to immediately position the retaining and traction means in the absence of bleeding^{18,20,21}.

In the few cases presenting an impossible orthodontic repositioning, the tooth could be extracted and repositioned after the creation of a correct eruptive space²³.

Conclusions

When a permanent incisor does not erupt within the expected time, a precise diagnosis is required to schedule a correct treatment. Studies detected that disinclusion and orthodontic alignment of unerupted incisors is a secure and useful treatment. Aligned teeth have a correct function and correctly preserve the alveolar ridge and periodontal tissues. The treatment is always influenced by the initial position of the impacted tooth: incisor that is horizontally inclined or in other severe ectopic position is more difficult to treat.

Despite the limited number of patients in our case series, to our knowledge, it reports the greatest number of un-erupted incisors treated with diode laser. Furthermore, our cases series shows that this approach is very easily performed and therefore it can be used also by dental practitioners not routinely involved in oral surgery interventions.

Conflict of Interests

The Authors declare that they have no conflict of interests.

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Authors' contribution

MM collected the data, reviewed the literature and prepared the manuscript. GLA collected the data. RV collected the data. RF reviewed and prepared the manuscript.

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No external funding was available for this study.

Consent

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Ethical approval

For case reports our local Ethics Committee only asks the patient's written informed consent in accordance with the ethical standards of the Helsinki Declaration of 1964.

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