ISSN 1855-9913

Journal of the Laser and Health Academy
Vol. 2017, No.1; www.laserandhealth.com

Minimally Invasive Surgery in Pediatric Dentistry using Dental Lasers

Dimitrios A. Velonis, Konstantinos Tsolakis
[1]*Private practice in Larisa, Greece*

ABSTRACT

Minor in-office oral surgical procedures in children are a significant challenge for the child and practitioner, especially when removal of bone is necessary and sedation is not available. Children require careful and educated behavioral management, even for simple procedures such as tooth cleaning, sealant placement and restorative treatment. Surgical procedures pose an additional stress to any child that is afraid of the "knife", the thought or sight of blood, "stitches", and in the case of bone removal also the sensation of pressure and vibration.

Dental laser systems, especially during the past ten years, have made it possible to simplify these procedures so that they can be performed with minimal fear and discomfort during the operation and minimal (if any) post-operative swelling or pain.

In our office (DAV), the Er:YAG/Nd:YAG laser has been used successfully over the past 7 years to perform minimally invasive surgery in cases of micro-marsupialization and removal of mucoceles, irritation fibromas, reactive hyperplasias, papillomas, pyogenic granulomas, odontomas, exposure of fully or partially impacted permanent teeth, lingual and labial frenectomies, and removal of granulation tissue.

In this paper we present four clinical cases where the dual Er:YAG/Nd:YAG laser (Fotona Fidelis plus II) has been used for 1. Removal of odontomas interfering with the eruption of the upper permanent central incisors, plus exposure and orthodontic eruption of the central incisors. 2. Surgical exposure of a palatally impacted upper permanent, and orthodontic eruption. 3. Removal of an irritation fibroma of the buccal mucosa. 4. Removal of an oral papilloma from the attached gingiva.

Key words: Minimally invasive surgery, impacted, oral surgery, odontoma, pediatric dentistry, Er:YAG, laser applications, perioperative anxiety, outpatient surgery.

Article: J. LA&HA, Vol. 2017, No.1; pp.28-32.
Received: April 7, 2017; Accepted: December 20, 2017

I. INTRODUCTION

In-office minor oral surgical procedures in children pose significant challenges for the child and practitioner. A recent study of 421 children in 21 private practices showed that the proportion of children with dental fear was 20% and the proportion of children with negative behavior during treatment was 21% [1].

In the medical world most outpatient surgical procedures in children are performed under some form of sedative premedication, or sedation. Even when sedation or general anesthesia are used, 60% of children experience significant perioperative stress and anxiety, even in modern operating room waiting areas [2]. In pediatric dentistry, the majority of dental and minor surgical procedures are performed in an outpatient setting. This is possible because of the development and application of an array of non-pharmacologic behavioral techniques by appropriately trained and skilled dentists [3].

The goal is to minimize stress and anxiety for both the patient and staff, but also minimize postoperative complications, pain, and improve patient acceptance and perception. This has not been easy to achieve with conventional surgical methods, especially where removal of bone was necessary, and sedation was not an option [4].

Children require careful and educated behavioral management, even for simple procedures such as tooth cleaning, sealant placement and restorative treatment. Surgical procedures pose an additional stress to any child that is afraid of the "knife", the thought or sight of blood, the stitching, and in the case of bone removal also the sensation of pressure and vibration [4].

Dental laser systems, especially during the past ten years, have made it possible to simplify these procedures so that they can be performed with minimal fear and discomfort during the operation and minimal (if any) post-operative swelling, pain, or other complications.

In this case series we report on four representative minor oral surgery cases performed with dental laser systems.

II. CASES

a) Case 1

This is a case of a boy with history of subluxation trauma to the upper central primary incisors before age 4. A change in the eruption sequence was noted at age 6y 6m. An orthopantomograph (OPG) revealed supernumerary tooth-like structures. Although he has had regular exams in the dental office, his behavior was rated no higher than Frankl 3 for sealant placement. The proposed treatment plan consisted of extraction of the primary central incisors as the first step, and clinical and radiographic re-evaluation after one year. A simple "Same Lingual Opposite Distal" (SLOB) technique was used to locate the odontomas palatally, which were removed in two separate appointments for better cooperation and in order to limit the appointment time needed, as well as to not exceed the limit for the amount of local anesthetic. Local anesthesia was achieved by labial and transpapillary infiltration of 54 mg of lidocaine with 0.33 μg of epinephrine. A minimal access through the palatal mucosa was used to locate and remove the odontomas. The soft-tissue access was achieved with an Er:YAG laser (Fotona) at 150 mJ, 20 Hz, VLP, without water irrigation, with an R07 contact handpiece with an 8 mm long, 1.3 mm diameter cylindrical sapphire tip. The spot size was 0.94 mm, peak power 150 W, mean power 3 W, and fluence 21.6 J/cm^2. Surrounding bone was cleared with an R07 contact handpiece with a 13 mm long, 1.3 mm diameter cylindrical sapphire tip at 200 mJ, 20 Hz, VSP, with air and water irrigation. The spot size was 0.94 mm, peak power 2 kW, mean power 4 W, and fluence 28.8 J/cm^2. No suturing was needed, and no antibiotics. Instructions were given to the child and mother for analgesics if needed. There was minimal bleeding. No discomfort or postoperative pain or swelling was reported. The boy returned for the second surgical removal session with improved behavior (!) when the same parameters were used. The eruption of the central incisors was re-evaluated 10 months later and it was decided to expose the mucosally, now-impacted central incisors, so that orthodontic forces could be applied. Only two months later the central incisors erupted, and a year later, satisfactory development of the periodontal apparatus was noted. An OPG of his brother at age 8 revealed the presence of odontomas and a mesiodens (Fig. 1).

Fig 1: Timeline showing external resorption of the roots of teeth #51 and #61 at age 3y 11m, and a first sign of supernumerary teeth at the periapical radiograph at age 6y 6m. Note the visible change in eruption sequence, the right lateral is erupting. An OPG at age 6y 6m revealed two tooth-like structures, and #51, #61 and #62 were removed. One year later (7y 6m) teeth #11 and #21 had not erupted. Surgical removal of the compound odontomas (or denticles) was successful, and permanent central incisors were left to erupt spontaneously for 10 months. A new OPG was taken and it was decided to facilitate the eruption by exposing the crowns (age 8y 6m) and applying orthodontic forces. Two months later (age 8y 8m) teeth #11 and #21 were in the oral cavity. His brother also had supernumerary teeth in the anterior maxillary region.

b) Case 2.

A 16-year-old girl was referred to our office for an upper permanent canine impaction. The referring dentist had removed the primary canines as soon as the impaction was diagnosed, and #23 (left upper permanent canine) erupted spontaneously, which did not happen for #13 (right upper permanent canine), Fig 2a. A Fotona Fidelis plus II Er:YAG laser was used to access the slightly palatally impacted #13. Soft tissues were removed at a setting of 150 mJ, 20 Hz, VLP, without water irrigation, with an R07 contact handpiece with an 8 mm long, 1.3 mm diameter cylindrical sapphire tip. The spot size was 0.94 mm, peak power 150 W, mean power 3 W, and fluence 21.6 J/cm^2. Covering and surrounding osseous tissue was cleared with an R07 contact handpiece with a 13 mm long, 1.3 mm diameter cylindrical sapphire tip at 200 mJ, 20 Hz, VSP, with air and water irrigation. The spot size was 0.94 mm, peak power 2 kW, mean power 4 W, and fluence 28.8 J/cm^2. Hemostasis was achieved with the Nd:YAG laser at 4 W, 40 Hz, 100 mJ, LP (320 µsec), with a 300 µm fiber in contact with the bleeding tissues. An orthodontic button and elastic chain were attached to the exposed part of the crown. Clinical images are intra-operative, immediately post-op, and 2 week follow up (F/U), Fig 2a. The button detached and the canine crown had to be re-exposed (Fig 2b, A-C). Finally a bracket was placed, and one year after the initial exposure the canine appeared in the oral cavity (Fig 2b, E), and 6 months later was almost in place in the upper dental arch (Fig 2b, F).

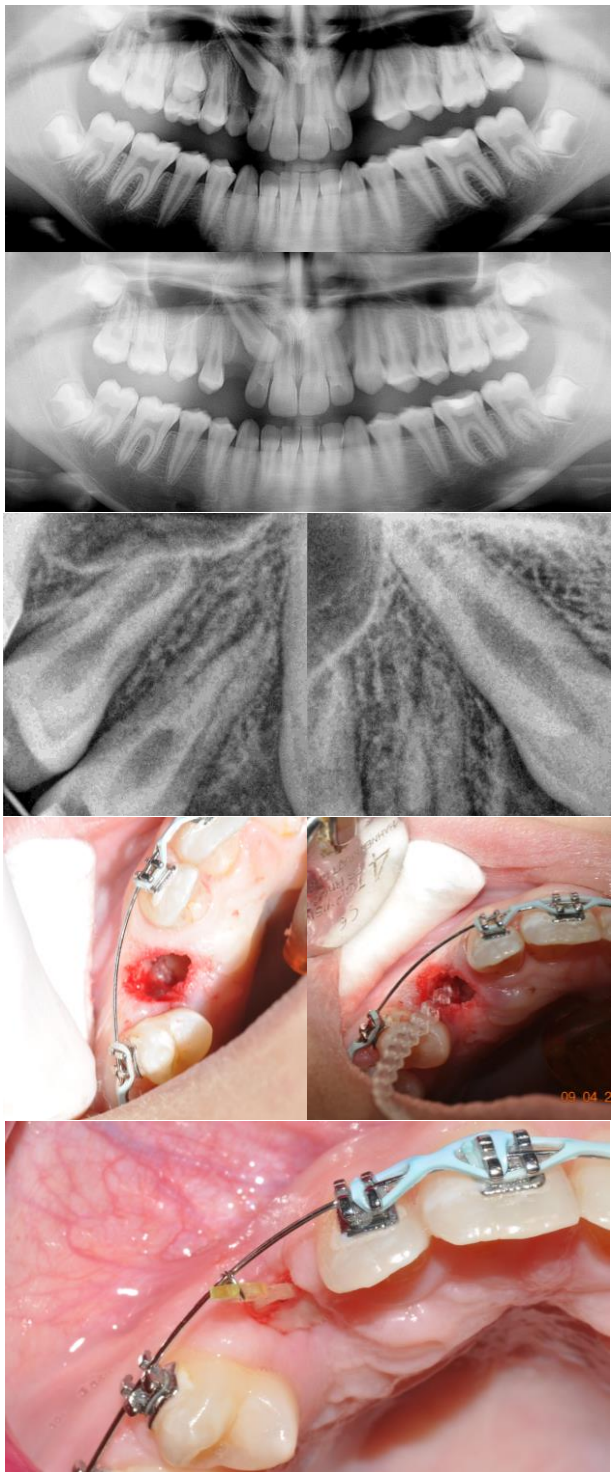

Fig. 2a: A. OPG showing failure of eruption of upper permanent canines at age 15. B. Removal of #53 did not result in spontaneous eruption of #13. C, D. SLOB technique. E. Exposure of the crown of impacted #13. F. Attachment of elastic chain and button with light-cured composite. G. 2-week-F/U, attachments in place, excellent healing.

Fig. 2b: A, B. Re-exposure after detachment of the chain and button. C. Attachment of bracket with chemically cured composite. D. 2 month F/U, E. 7 months after re-exposure, canine emerging. F. Canine approaching its final position in the arch.

c) Case 3.

A 16-year-old boy complained of a bump on the inner side of his lip. It was not painful. Upon intraoral examination, a 0.5 cm diameter, sessile, exophytic lesion was noted on the right buccal mucosa at the corner of the mouth. The color was that of the normal mucosa, and the surface was smooth and not traumatized. Differential diagnosis included diapneusie, irritation fibroma, fibroma. The lesion was removed under local anesthesia with 20 mg lidocaine and 0.11 μg epinephrine infiltration around the lesion. The lesion was held with forceps and removed with an Nd:YAG laser (Fotona) at a setting of 3.2 W, 80 Hz, 40 mJ, VSP (100 μsec), 300 μm fiber from its base. Fluence was 56.6 J/cm^2, peak power 400 W. There was no bleeding, no need for suturing and no antibiotics or analgesics were prescribed. Healing was excellent without scarring. No pain or swelling were reported, and no recurrence was noted after one year F/U (Fig. 3).

Fig. 3: Pre-operative and immediately post-operative views of the surgical site. Excellent healing at 2 weeks and one year without scarring or recurrence.

d) Case 4.

A 10-year-old girl noticed a "peculiar growth on her gums" that was growing during the past month and was not bleeding upon brushing. On intraoral examination, a 1 cm exophytic band-like lesion was observed following the attached gingivae contour of the left upper primary canine. The lesion was of irregular surface, pedunculated on its base, and differential diagnosis consisted of oral papilloma (oral wart) and pyogenic granuloma. The lesion was removed under local anesthesia with 20 mg lidocaine and 0.11 μg epinephrine infiltration at the mucobuccal fold. The lesion was held with forceps and removed with an Nd:YAG laser (Fotona) at a setting of 4 W, 100 Hz, 40 mJ, VSP (100 μsec), 300 μm fiber from its base. Fluence was 56.6 J/cm^2 and peak power was 400 W. There was no bleeding, no need for suturing and no antibiotics or analgesics were prescribed. Healing was excellent without scarring, and no pain or swelling were reported. No recurrence was noted after 6 months F/U (Fig. 4). The biopsy report confirmed the diagnosis of oral papilloma.

Fig. 4: Pre-operative and immediately post-operative views of the surgical site. Excellent healing at 7 months without scarring or recurrence.

III. DISCUSSION

The use of general anesthesia for dental procedures in children has increased in recent years [5]. While pharmacologic behavioral management by-passes the child's cooperation [6], most non-pharmacologic behavioral management techniques used (such as distraction, Tell-Show-Do, Humor, imagery, sound signals, audiovisuals, etc.) improve behavior and cooperation [7].

When surgical procedures are planned, most children experience anxiety and fear of the needle, injection, knife, sutures, and blood.

The dental laser systems is an additional tool in the hands of the pediatric dentist to use along with other non-pharmacologic behavioral techniques, in order to better prepare the child for cooperation and minimize perioperative anxiety. It is our experience, as well as it is documented in the literature, that surgical procedures performed with a laser system following appropriate technique and protocol result in minimal discomfort, and minimal post-operative pain or complications. This provides us with the ability to reassure the young patient and the parents and raise confidence in the approaching surgical appointment [8, 9].

In this paper we showed four representative cases where the combination of non-pharmacologic behavioral management techniques, together with surgical operations performed by laser systems, has resulted in excellent cooperation, minimal trauma and discomfort (if any), and avoiding sedation or general anesthesia. In a recent paper, Hanna & Parker found that the use of the carbon dioxide laser for soft-tissue oral surgical procedures in children was a desirable and acceptable technique with no post-operative complications and reported pain scores close to zero [8].

REFERENCES

1. K. Baier, P. Milgrom, S. Russell, L. Mancl, and T. Yoshida, "Children's fear and behavior in private pediatric dentistry practices," Pediatr. Dent., vol. 26, no. 4, pp. 316–321, 2004.
2. M. A. Fortier and Z. N. Kain, "Treating Perioperative Anxiety and Pain in Children: A Tailored and Innovative Approach."
3. D. M. Strange, "The evolution of behavior guidance: a history of professional, practice, corporate and societal influences.," Pediatr. Dent., vol. 36, no. 2, 2014.
4. S. Raj, M. Agarwal, K. Aradhya, S. Konde, and V. Nagakishore, "Evaluation of Dental Fear in Children during Dental Visit using Children's Fear Survey Schedule-Dental Subscale.," Int. J. Clin. Pediatr. Dent., vol. 6, no. 1, pp. 12–5, 2013.
5. P. Rajavaara, S. Rankinen, M.-L. Laitala, H. Vähänikkilä, H. Yli-Urpo, S. Koskinen, and V. Anttonen, "The influence of general health on the need for dental general anaesthesia in children," Eur. Arch. Paediatr. Dent., Mar. 2017.
6. A. Kupietzky, "General anesthesia or chemical restraint?," Pediatr. Dent., vol. 28, no. 1, pp. 7–8.
7. M. L. Goettems, E. J. Zborowski, F. dos S. Costa, V. P. P. Costa, and D. D. Torriani, "Nonpharmacologic Intervention on the Prevention of Pain and Anxiety During Pediatric Dental Care: A Systematic Review," Acad. Pediatr., vol. 17, no. 2, pp. 110–119, Mar. 2017.
8. R. Hanna and S. Parker, "The advantages of carbon dioxide laser applications in paediatric oral surgery. A prospective cohort study," Lasers Med. Sci., vol. 31, no. 8, pp. 1527–1536, Nov. 2016.
9. R. Broccoletti, A. Cafaro, A. Gambino, E. Romagnoli, and P. G. Arduino, "Er:YAG Laser Versus Cold Knife Excision in the Treatment of Nondysplastic Oral Lesions: A Randomized Comparative Study for the Postoperative Period," Photomed. Laser Surg., vol. 33, no. 12, pp. 604–609, Dec. 2015.