Laser in paediatric dentistry: patient acceptance of hard and soft tissue therapy

M. D. GENOVESE, G. OLIVI*

*Abstract. **Aim** This study aimed to evaluate the laser therapy efficacy in paediatric dentistry, considering the subjective tolerance and acceptance of therapy in children needing both dental and soft tissue treatments. **Methods** A group of 50 patients from 6 to 12 years of age, needing both hard and soft tissue therapy was selected and treated, without anesthesia, with an Er,Cr:YSGG laser 2780 nm and an Er:YAG laser 2940 nm for a total of 100 treatments performed; before and after the treatment the patients experience was tested with Wong-Baker modified facial image scale. **Results** The study showed a good percentage of acceptance and tolerance of both laser treatments: a success rate of 90% for hard tissues and 63% for soft tissues was obtained; for the total 100 treatments the acceptance was of 75%. **Conclusion** The Erbium lasers are very effective in paediatric dentistry and are good treatment options.*

Keywords: Paediatric dentistry; Laser therapy; Threshold of pain; Threshold of suffering.

Introduction

Many people report fear of pain as their chief reason for not seeking dental care (Smith et al,1993), so any new technology that decreases dental pain is of great interest to both dentists and patients.

Laser therapy in paediatric dentistry is a therapy of choice for its known advantages (Table 1), especially for the safety of its use and for its gentle approach with patients. But is the laser sufficient to obtain no-pain dentistry? The answer comes from the knowledge about the nature of pain and the connection between its neurological and psychological components.

The nature of pain. In dentistry, the absence or the perception of pain is the result of a mixture of subjective and objective factors; both are variable and make pain a personal experience that no one has in common.

Among the objective factors, we must consider the type and the severity of the lesion (for example a simple enamel decay or a deep cavity with pulp exposure), the dentist's knowledge and ability, the technique and instruments used.

Among the subjective factors we must consider the threshold of pain, the limit of algic perception which is almost constant in people, and the threshold of suffering that is the individual tolerance of pain (Molina and Magnano, 2005).

The threshold of suffering depends on individual factors, such as the patient's memory of pain (cognitive component), on the emotional status of the patient (emotional component) and on the social

Università di Genova DI.S.TI.BI.MO

e-mail: olivi.g@tiscali.it

Laser in paediatric dentistry		
Operative advantages	Safety	No rotary instruments used
	Comfort	No vibration-no contact
	Painless	Reduction of need for local anaesthesia
Clinical advantages	Minimal invasive cavity preparation	
	Bactericidal effect	
	Haemostatic effect	
	Direct and indirect pulp capping indications	
	Good soft tissue healing	
	Improvement of patient approach	

Table 1 - *The advantages of laser therapy in paediatric dentistry.*

behaviuor (behavioural component), that is to say the "fight or flight reaction" or the individual willingness to react to the pain; therefore the threshold of suffering is the psychological interpretation of pain.

Transmission of pain stimulus begins peripherally with:

1) signal transduction by the action potential (threshold intensity) and continues with its,
2) transmission toward the central nervous system;
3) modulation (acceleration or inhibition) along the path into the cephalic section; the pain stimulus finishes with the
4) perception of pain in the cephalic nervous centre where it will be individualised by fibres that connect the thalamus with the somatic-sensitive cortex (cognitive component), the limbic system (emotional component) and the hypothalamus (behavioural component) (Fig. 1).

Depending on the patient's imprinted experiences of pain, the four psychological aspects (modulation, cognitive component, emotional component and behavioural component) influence each other.

During a painful experience for a person with negative imprinting, pain stimulus is accelerated into the cephalic section, the sensitive cortex sends important signals, the limbic system sends emotions and the suffering will be considerable with a behavioural overreaction, whatever the intensity of the pain stimulus.

Considering the difficulty of evaluating pain objectively, this study seeks to evaluate the subjective laser therapy acceptance and tolerance in children needing both dental and soft tissue therapy, using an Erbium Chromium YSGG laser 2780 nm (Waterlase Millennium, Biolase technology-Irvine, CA, USA), and with an Erbium:YAG 2940 nm (Delight, Hoya-Combio-Santa Barbara, CA, USA), and checking the impact of laser on their perception of pain.

Materials and methods

A group of 50 patients, from 6 to 12 years of age, needing both hard and soft tissue therapy, were selected and treated; a total of 100 treatments were performed: 50 soft tissue and 50 hard tissue therapies.

Two groups were identified.

- Group H (hard tissue) with 20 permanent molars first class cavity preparation (dentin decay, grade II and III) and 30 deciduous molars first and second class cavity preparation (dentin decay, grade II and III) (Table 2).
  Parameters and operative mode used for these hard tissue therapies are reported in Table 3.
  In order to achieve laser analgaesia, the laser was positioned at a distance of 3 mm from the tooth surface, in defocused mode on the gingival margin (1-3 mm), and slowly moved for 2 min using the parameters outlined in Table 9 to obtain analgaesia. Laser power settings were gradually adjusted for enamel and dentin cutting and for carious removal.
- Group S (soft tissue) with 23 frenectomies, 12 gengivectomies and 15 operculectomies (Table 4).
  Parameters and operative mode used in soft tissue procedures are reported in Table 5. The same technique used for laser analgesy in hard tissue therapy was used.

The children were instructed in the Wong-Baker [Wong and Baker, 1988; Buchanan and Niven, 2002; Boj et al., 2005] modified facial image scale: patient's experience was tested before and after treatment and every child completed the test (Table 6).

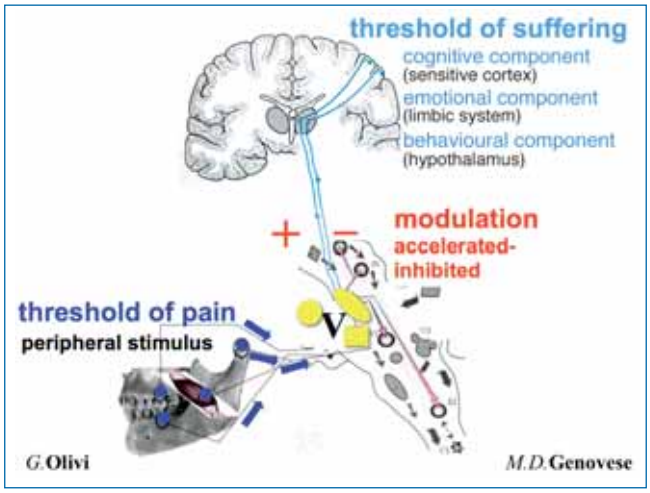

FIG. 1 - *Pain stimunus transmission into cephalic center.*

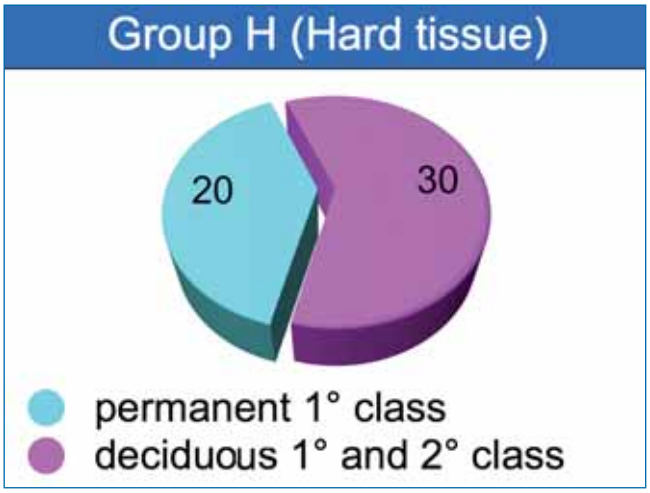

TABLE 2 - *Materials and metods: hard tissue.*

	Enamel	Dentin
Er,Cr:YSGG		
Air	92%	65%
Water	80%	55%
Watt	4.5	2.5>3.5
Hz	20	20
mJ	225	125>175
Er:YAG		
Watt	4.5	2.5>3.5
Hz	20	20
mJ	225	125>175

TABLE 3 - *Group H (hard tissue) laser setting.*

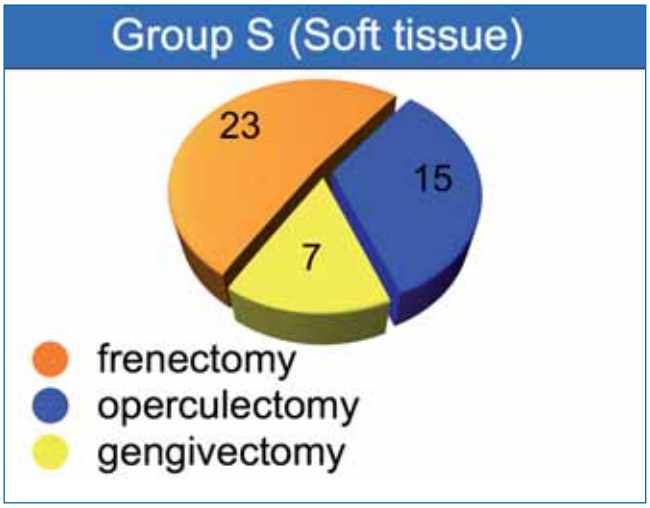

TABLE 4 - *Materials and methods: soft tissue.*

	Er,Cr:YSGG	Er:YAG
Air	20%	
Water	15%	
Watt	1.5	1.5
Hz	20	20
mJ	75	75

TABLE 5 - *Group S (soft tissue) laser setting.*

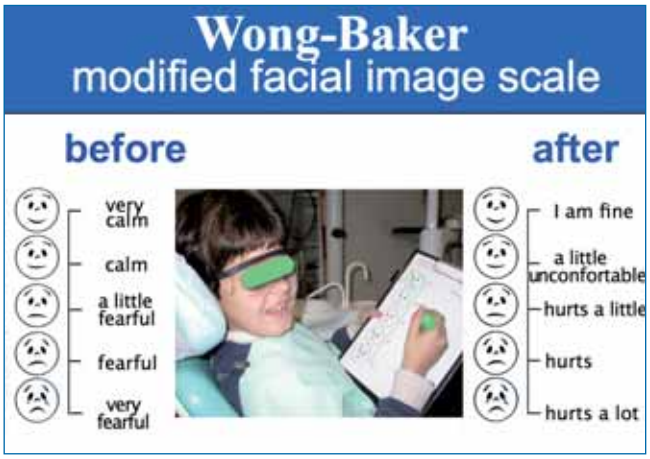

TABLE 6 - *Facial image scale.*

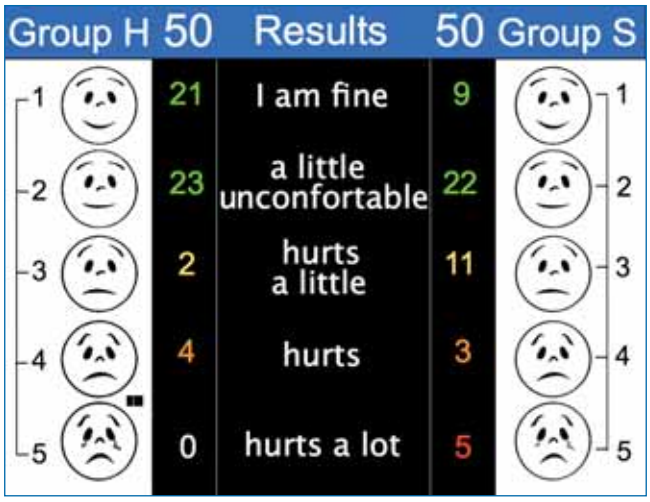

TABLE 7- *Acceptance detailed results.*

Results

All the cases of restorative therapy (Table 7) were performed without anaesthesia and only 6 patients reported a 3 or 4 level of pain on a scale of 1 to 5, even in cavities that were not deep (grade II); the remaining 44 patients reported a low pain level of 1 or 2.

For the soft tissue therapy (Table 7) the same 6 patients plus other 2 needed local anaesthesia during frenectomy, reporting a 4 or 5 level score, while all the other patients reported level 1 to 3 using a topical anaesthetic.

The hard tissue therapy was carried out without anaesthesia and with good collaboration of the patients in 90% of cases.

The soft tissue therapy, certainly more invasive due to the need to vaporise the collagen fibres inserted into the palatal papilla in frenectomy, presented a good acceptance in 62% of the treated patients.

A total success rate (good acceptance: level 1-2) of 75% for 100 treatments performed was obtained; 13% reported “hurt a little” (level 3) and 12% reported no acceptance (level 4-5) (Table 8).

Discussion

The perceived pain is not only physical but also mental.

The brain generates the experience of the body and the sensory inputs modulate that experience (Melzack, 1992); this input does not directly cause the pain which depends on a personal or family history of pain and on the consequent patient emotions when he/she undergoes dental treatment.

A child who has never been treated by a dentist, without negative family influence, with normal emotions (calm, happy) will accept the dental treatment well. The positive impact with dentistry will be increased using the laser without the use of needles, anaesthesia or vibrations, and the patient will develop a lasting trust toward the dentist.

On the opposite side, a patient with a history of pain, personal or family experience, with altered emotions (agitated, nervous) cannot be treated without an appropriate psychological approach or it will be a failure, even using the laser. The psychological approach requires the correct environment, time, technique, and alternative instruments, like the laser. The motivation of child and parents towards the use of the new instrument will be important and should be presented separately as follows:

- firstly parents will be informed about laser technique and its exclusive advantages to prepare their children for the dental treatment, using the correct words;
- then the child will be approached alone explaining verbally and showing visually the procedures that will be performed, using the tell-show-do technique (Fig. 2, 3).

The use of key words (white light, magic wand, cold water to clean teeth, et cetera) can help motivate the patient to collaborate for his/her own health.

Naturally, to stay below the pain threshold and not betray the child's trust, we need to take advantage of laser therapy, inducing analgesia, by raising cell membrane potential, thereby raising the threshold of pain (Table 9).

We must continue the treatment using the minimal

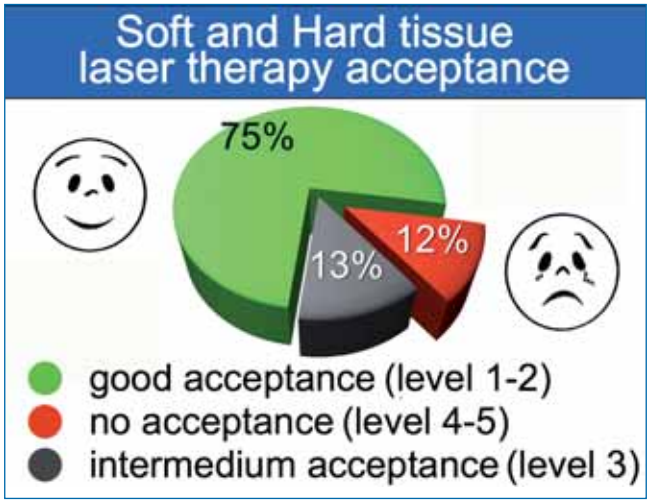

Table 8 - *Acceptance general results.*

Fig. 2 - *Tell-show-do technique.*

Fig. 3 - *Tell-show-do technique.*

	Er,Cr:YSGG	Er:YAG
Air	20%	
Water	15%	
Watt	0.5>2.5	0.5>2
Hz	20	20
mJ	75	75

Table 9 - *Analgesy laser setting.*

effective energy and power, so as not to surpass the algic perception threshold.

According to this psychological and clinical approach, our study showed a good percentage of acceptance and tolerance of both laser therapies (hard and soft tissues).

Conclusion

The laser technique used in this clinical study was very effective for its applications and, above all, for the good level of patient acceptance registered during hard and soft tissue therapy. In a few cases of low tolerance to both the therapies, in the same patients, it may be possible that psychological implications and a low individual pain threshold have negatively influenced the subjective reactivity to every dental therapy and to laser therapy as well.

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Recent publicity about the benefits of lasers in dentistry has generated considerable interest among dental professionals and the public.Â Soft Tissue Lasers. The types of lasers most commonly used for periodontal applications are the diode, CO2, Nd:YAG and erbium:yttrium-aluminium-garnet (Er:YAG) (Table 1). All but 1 transmit the laser energy through an optical fibre, allowing the use of a handpiece and contact to provide tactile feedback.Â Patient acceptance of laser therapy is reportedly good.7 Patients often perceive laser therapy as a contemporary, progressive, more conservative and less painful approach than surgery. However, although the patientâ€™s wishes should not be discounted, neither should they overrule the weight of scientific evidence. Erbium laser ablation of dental hard tissue: effect of water cooling. Lasers in Surgery and Medicine. 1996; 18: 294-300.Â 20. Genovese MD, Olivi G. Laser in paediatric dentistry: patient acceptance of hard and soft tissue therapy. European Journal of Paediatric Dentistry. 2008; 9: 13-17. Director, Laser Dentistry, New York Hospital Medical Center of Queens, New York, NY; Evaluator, Clinical Research Associates, Utah; Fellow, Academy of General Dentistry; Fellow, American Society of Lasers in Medicine and Surgery. Dr. Convissar is a pioneer in the field of laser dentistry. One of the first practitioners to incorporate lasers into dental practice, he has over 25 years of experience with CO2, Nd.YAG, Diode, and Erbium lasers.Â They will also participate in a hands-on workshop on how to perform soft tissue surgery, and how to remove tongue-ties through the use of soft-tissue lasers. The following procedures will be discussed: Frenectomy/Gingivectomy/Tooth exposure/Pericoronitis. Drug induced hyperplasia treatment (Phenytoin, Cyclosporine, etc.) Soft-Tissue Lasers and Procedures. A Peer-Reviewed Publication Written by Raymond J. Voller, DMD, MAGD.Â used in dentistry for many types of procedures, including hard-tissue procedures, soft-tissue procedures and the identification of carious lesions, as well as in relation to orthodontic therapy, periodontal and endodontic procedures.1,4-8 Recently, dental lasers have been investigated for the treatment of bisphosphonate-induced osteonecrosis, and research is being conducted on the influence of laser therapy on the rate.Â Patient acceptance of laser therapy has been found to be high, including in pediatric patients, with one study of pediatric patients finding that acceptance of laser treatment for hard- and soft-tissue procedures combined was 75%.31. This study aimed to evaluate the laser therapy efficacy in paediatric dentistry, considering the subjective tolerance and acceptance of therapy in children needing both dental and soft tissue treatments. A group of 50 patients from 6 to 12 years of age, needing both hard and soft tissue therapy was selected and treated, without anesthesia, with an Er,Cr:YSGG laser 2780 nm and an Er:YAG laser 2940 nm for a total of 100 treatments performed; before and after the treatment the patients experience was tested with Wong-Baker modified facial image. scale.