# Preventive approach in paediatric dentistry using Er:YAG laser

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**Figs. 1a & b**_Acid etching of hypoplastic enamel showed patchy loss of surface tooth structure without evidence of uniform etching patterns (a). The laser treated surfaces showed that Er:YAG radiation caused an uniform roughness of the enamel for HE (b) teeth (magnification x 3,000).

**_Modern dentistry has focused on preventive methods** and conservative techniques to apply less-invasive procedures to tooth structure.[1] Awareness towards the importance of preserving tooth tissue combined with a patient-friendly approach is becoming self-evident. It has been shown that operative dental treatment often leads to an increasing scale of more surgical and invasive treatments. Whenever possible, tissue should be preserved, and invasive treatment should be kept to a minimum. The best way to ensure maximum life for the natural tooth is to respect the healthy tissue and protect it from being damaged by using minimally-invasive techniques in restorative dentistry.[2]

## _Preventive dentistry

Preventive dentistry is a branch of dentistry that deals with the preservation of healthy teeth and gingiva and the prevention of dental and oral disease. The field involves dental procedures, materials and programmes that prevent the occurrence of oral diseases or retard their further progression. There are three levels of preventions:

*Level 1: Primary prevention*

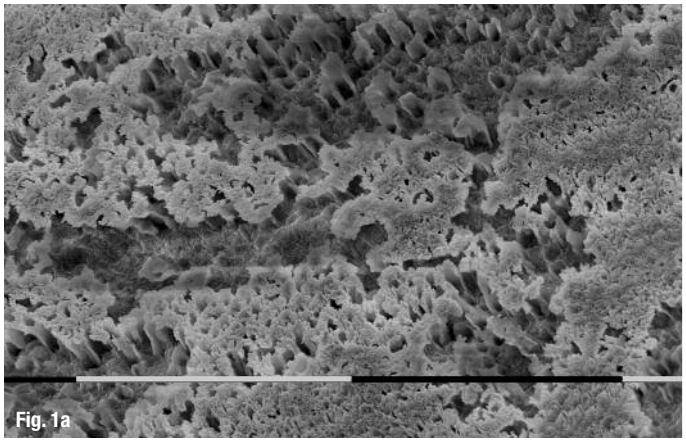
The pre-pathogenic stage employs measures that forestall the onset of the disease to reverse the progress of the initial stage, or to arrest the disease process before treatments becomes necessary.

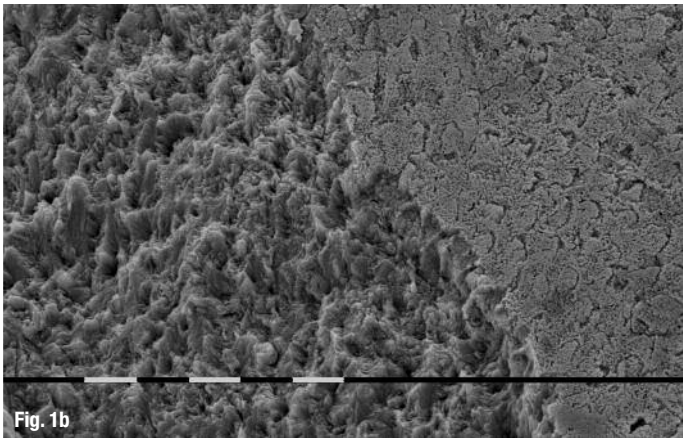
*Level 2: Secondary prevention*

The pathogenic stage employs treatments methods, to terminate a disease process and to restore tissues as near normal as possible.

*Level 3: Tertiary prevention*

At this level, prevention employs measures that are necessary to replace much tissue and to rehabilitate patients to the point that functionality resembles its natural condition, as much as possible, after the failure of the secondary preventions.


Fig. 1a


Fig. 1b

In recent years, the development of new technologies made it possible to prevent complications and to conduct treatments with minimal intervention. Laser treatment with its considerable variety of biological actions and high therapeutic effectiveness is used widely both in medicine and dentistry. Erbium lasers could be used in large array of both hard and soft tissue procedures performed in paediatric dentistry.[3] Many of these procedures may be treatments that require a specialist. However, when Er:YAG lasers are being used their efficacy and special characteristics allow general practitioners to perform and complete a wide range of these procedures. The advantages of Er:YAG laser are associated with a process of ablation, decontamination, minimal invasion and analgesia, thus providing clinical solutions to what once was attribute solely to experts. The purpose of this study is to describe the scientific approaches to prevention by using Er:YAG lasers.

## _Er:YAG laser characteristics and advantages

*Ablation*

Er:YAG laser has a wavelength of 2.94 µm, which matches exactly the absorption peak of water and which is also absorbed by hydroxyapatite. Erbium laser radiation is very efficient in removing both dentin and enamel, limiting the laser effect on these tissues to a superficial layer of a few micrometres. The overheated water abruptly vaporises and the so released vapour carries away surrounding broken tissue fragments in a thermo-mechanical ablation process.[4, 5]

In general, there is a linear relationship between crater depth or removed volume and applied energy density.[15] Water mist is needed to avoid thermal side effects and for pain control.[6] The way to remove hard tissues with Er:YAG without overheating prevents the pulp. Er:YAG laser ablation works in a minimally-invasive way, removing only the damaged tissues. It prevents destruction of sound structures and gives opportunity for a fast healing process.

*Decontamination*

The bactericidal effect of laser light was advanced to be one of its beneficial effects. The wavelengths well-absorbed in water have a good bactericidal effect even at low-energy density output levels, starting at 0.3 J/cm$^2$, without excessive temperature elevation.[7] Due to its bactericidal effect combined with the reduced pain sensation during its application, the Er:YAG laser was a very promising tool for cavity preparation in Paediatric Dentistry and in Dentistry in general. Antimicrobial resistance or drug resistance is a problem spread and discussed worldwide. It is a major concern of the WHO. The ability of Er:YAG laser to establish decontamination is a solution for effective treatment and prevention of future complications.



Fig. 2a



Fig. 2b

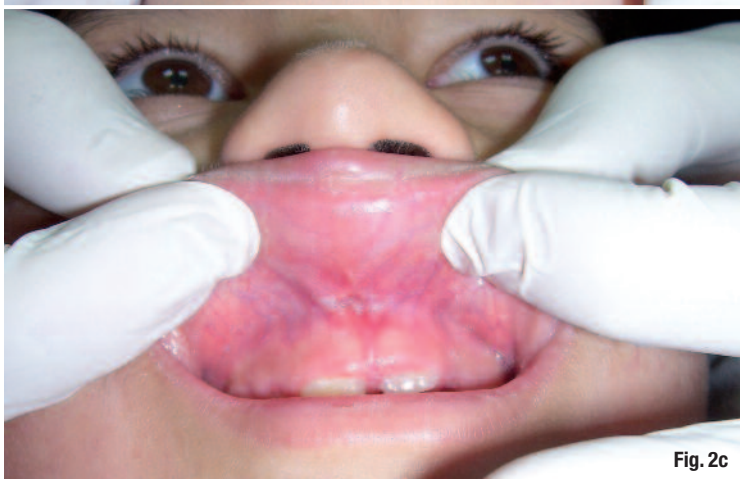


Fig. 2c

**Figs. 2a–c**_Maxillary frenectomy with LiteTouch, Er:YAG laser.

*Analgetic effect and pain perception*

As Er:YAG lasers can be used to prepare cavities without thermal damage and the systems availability on the market offers a high ablation efficiency, it was of interest to investigate the patients' subjective perception of this treatment method: Cavity preparation with the help of Er:YAG laser was found to be more comfortable in the patients perception than mechanical treatment in at least 80 per cent of the cases.[10, 11]

One of the parameters partly explaining the absence of pain perception is the difference in tooth vibration


Fig. 3a


Fig. 3b


Fig. 3c

**Figs. 3a–c**_Lingual frenectomy of 7-year-old boy with Lite Touch, Er:YAG laser.

speed caused by Er:YAG laser versus high-speed drill. Mean vibration speed during laser cavity preparation reaches 166 +/- 28 µm/second, at a characteristic frequency of 230 Hz, whereas the high-speed drill induces a 100 times higher vibration speed of 65 +/- 48 mm/second, at 5 kHz. In addition, this much higher frequency has its spectrum near the peak sensitivity of hearing, as a potential factor of discomfort and pain provocation.[12]

A patient may suffer progression of oral disease if treatment is not provided on time because of age, behaviour, inability to co-operate, disability, or medical status. Postponement of dental care can result in unnecessary pain, discomfort, increased treatment needs and costs, unfavourable treatment experiences, and diminished oral health outcomes. Using Er:YAG laser in patients with fear or phobia of dental treatment is a real opportunity to treat them and show an alternative well-accepted method to overcome the barrier of dental care. With the help of Er:YAG laser, patients realise that there is a way to preserve their teeth without pain, which will encourage them to take care of their oral health more frequently and at the end only for prevention.

## _Application of Er:YAG laser in hard tissues

*Primary Caries Prevention*

Laser is becoming common in clinical dental care and is one of the promising new modalities used for caries management. In many studies was investigated the possibility of sub-ablative energies to increase the acid resistance and the micro-hardness of enamel surface and to reduce enamel solubility by increasing caries resistance without severe alterations of the enamel.[13] Laser–fluoride effect on enamel found that low-energy Er:YAG laser irradiation coupled with fluoride treatment could inhibit enamel demineralisation through increased fluoride deposition on the surface and formation of fluoridated hydroxyapatite.[14] In one recent study, silver diamine fluoride (SDF ) application followed by sub-ablative low-energy Er:YAG laser irradiation on dentine rendered the dentine surfaces more resistant to caries development, both chemically and mechanically.[15] Lasers have also been used to prevent the enamel demineralization caused by dental caries and have shown good results.[16,17] The Er:YAG laser has been shown to reduce or prevent the demineralization of tooth enamel.[18] In some studies, when associated with fluoride, it leads to a reduction in mineral surface loss.[19,20]

Sealants reduce the risk of caries in susceptible pits and fissures of primary and permanent teeth.[21] The enamel surface prior to the placement of the sealant can be pre-treated in different ways. Non-invasive techniques include only etching with 37 per cent orthophosphoric acid or air abrasion and acid etching. Invasive techniques use burs for opening the deep and narrow fissures and then acid etching. Preparing the enamel surface with Er:YAG laser with subsequent acid etching is considered as non-invasive technique for pre-treatment of pits and fissures. This laser wavelength has special uses in the domain of primary and secondary prevention which include sealing of pits and fissures and cavity preparation.[22] This technology makes the enamel more resistant to caries attack, and also the need to acid etching procedure is eliminated, or reduced.[22,23] The use of laser gives the dentist the ability to clean and sterilise enamel fissures. The bactericidal effect of Er:YAG laser irradiation could boost the inter-





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est in the already widely accepted pits and fissures sealing procedures. A simultaneous cleaning, conditioning and decontamination in hardly accessible depths of fissures would open a new perspective to this preventive treatment. Er:YAG pre-treatment and subsequent acid etching with highly concentrated phosphoric acid was equivalent to etching only.[1] The long-term success rate of a fissure sealant depends on its resistance to microleakage, its retention and micromechanical adhesion to the enamel surface, that is remaining completely intact.[24,25]

No significant difference in microleakage was reported between extended fissure sealing with a bur and phosphoric acid-etching or Er:YAG and phosphoric acid-etching. Laser irradiation did not eliminate the need for etching enamel.[26] Sealing the sound fissures reduces the risk of caries and the use of Er:YAG laser for conditioning and enamel sterilisation preserves the tooth surface for a long time. There were some important differences between the results of various studies in evaluation of the bond strength of restorative material bonded to teeth surfaces etched or conditioned with Erbium laser family and with acid etch technique. These differences could be the results of laser parameters (energy and frequency) and the type of restorative material used. The obtained SEM images showed an increase in retention of restorative material for the surfaces irradiated by laser and a decrease in bacteria in the pits and fissures, the sterilisation property of laser on irradiated surfaces is seen. In general, the best results have been obtained in simultaneous use of laser and acid.[1,27,28]

Etching pattern of defective enamel is vague and has no resemblance to that of normal enamel.[29] This could be due to difference in structure and composition of defective enamel. Seow W.K. and Amaratunge suggested that variation of etching patterns could be due to differences in orientation of crystallites relative to the direction of attack together with differences in chemical composition between central and peripheral parts of enamel prisms.[30] This explanation may highlight the variation in enamel structure that can occur not only between normal and defective enamel but also from tooth to tooth, or site to site, on a single tooth surface.[31] Also, variation of etching patterns for defective enamel could be a result of different aetiology of the enamel defects in different teeth which is unknown.[30] These variations may result in problems in bond strength.[29] Hypoplastic enamel surfaces prepared with Er:YAG laser LiteTouch are characterised by a rough and regular topography without presence of smear layer in contrast with the surfaces treated with acid (Figs. 1a & b). The acid etching of a less organised hypoplastic enamel structure may result in a pattern that is not the classic etched pattern, which may have a detrimental effect on bonding between the adhesive materials and the affected enamel. Laser ablation procedures change enamel and the surfaces appeared strong retentive and suitable for adhesive restorations.[32,33] Preparation of hypoplastic or hypomineralised enamel with Er:YAG laser is a way to reconstruct the surface for achievement of better adhesion. If the surface is not retentive enough, the adhesion will be poor and this can compromise the restorations. Laser treatment with Er:YAG laser proposes effective bond strength.[33]

## _Restorative dentistry

Er:YAG laser wavelength of 2,940 nm is strongly absorbed by water. It is thus effective and efficient in dental hard tissue ablation. Er:YAG laser has been studied in periodontics[37], restorative[38] and surgical treatments.[39] A great advantage of Er:YAG is that it has little chance of pulpal damage if used under sufficient water cooling. Minimal pain has been reported with its use, and it is thus used without local anaesthesia. During cavity preparation, the procedure begins with the use of very low-energy settings of the laser in order to achieve an analgesic effect on the tooth involved. Then the higher-power setting of the laser is used in order to remove the enamel and expose the infected dentin. Subsequently, the low-power setting is used once again to remove decayed dentin.[34] Different ablation rates for carious and sound tissue lead to selective removal of carious lesions.[32] No smear layer is formed with the application of laser, which results in an increase in bond strengths.[32]

Er:YAG lasers are selective for carious tissue and comfortable in use. The introduction of a new generation of Er:YAG lasers in 2007 finally made it possible to enjoy a device that automatically balances high energy output with a wide range of frequency ranges that free from conducting settings calculations while treating their patients—saving them time and worries. There is a laser in the market from the Er:YAG family including pre-set options, with perfectly balanced high energy output with a wide frequency range along with the precision control of pulse duration that fits the selected procedure. Thus, the dentist is concentrated in his work with no need for complicated calculations. The array of indications covers almost every possible treatment of dental hard tissue from simple fissure sealing to cavity preparation. It is important to point out the positive and preventive clinical dental care that is one of the promising new modalities used for caries management. The combined fluoride-laser-treatment makes enamel more resistant to acid than do either laser or fluoride treatments alone.[14,35] Er:YAG laser can also transform enamel hydroxyapatite into fluoridated hydroxyapatite to reduce enamel solubility as a preventive treatment for enamel caries.[14]

Compared to the smooth appearance of the cavity walls after bur preparation, cavity margins and walls are irregular but without any smear layer after ablative

Er:YAG irradiation.[39] Conservative dentistry as its name says is a part of dentistry that uses more conservative or minimally-invasive approaches to fulfil its goals. That is why preparing the hard tooth structures with Er:YAG proposes minimal intervention and prevention with respect to the sound tissues. The minimal penetration and lack of thermal changes in the pulp prevent the occurrence of complications.

## _Laser Application in soft tissues

*Maxillary frenectomy*

The abnormal junction of the frenum on the maxilla results in diastema between teeth, weak hygiene, gingival retraction, and repetitive trauma during tooth brushing. The best laser for the treatment of such a condition is the Erbium laser that is used simultaneously with water spray. This intervention is performed without the need of suturing, scar tissue formation and any problems in healing. Usually, frequencies between 30–45 Hz and an energy between 35–55 mJ are used. On the other hand, with the use of laser, limitation of the amount of hemorrhage during the surgery helps to provide a better field view for surgeon. Furthermore, patient's comfort after surgery is without doubts one of the biggest advantages for patients.[51–53]

Figures 2a-c show a case of a 6-year-old boy with a revision of the maxillary frenum. When the labial frenum is penetrating the palate or papilla it will have the potential for developing orthodontic abnormalities, discomfort, difficult articulation or even carious lesions from poor hygiene. That's why an early frenectomy of such a harmful frenum could prevent the development of the mentioned pathology.

*Lingual frenectomy in ankyloglossia*

Ankyloglossia is a frequent finding in newborns that can cause significant problems in terms of breast feeding, nutrition and speech if the adhesion is severe. For the treatment of this condition Erbium laser with topical anaesthesia or little needle anaesthetic are used (Figs. 3a–c).[64] The lingual frenum is incised with low energy 50 mJ, 10–15 Hz. The parameters must be changed if more fibrotic tissue is present or haemostatic effect is necessary. Laser frenectomy of the lingual frenum prevents speech disorders, as the correct phonetic, that are formed during the first ages of life. When there is mechanical reason such as thick and tight lingual frenum that limits the mobility of the tongue the feeding will also be disturbed. Restoration of the normal tongue mobility makes easier the clinical work on the rest of the dentition.

*Exposure of unerupted teeth during orthodontic treatment*

For soft tissue removal and exposure of unerupted permanent teeth for orthodontic objectives it is possible to use different wavelengths of lasers, including Er;Cr:YSGG, Nd:YAG, Er:YAG and Diode laser. Erbium laser has the ability to remove soft and hard tissues. When using this laser, one should pay close attention to the enamel in the surgical point surroundings. This risk doesn't exist when using diode and Nd:YAG since their wavelengths do not interact with hard tissues. For tooth exposure, only soft tissue removal is necessary. Most of the time the surgery can be performed without the need of a local anaesthesia but with the application of topical anaesthetic only, which is a big advantage in the treatment of small patients. The parameters should be


Fig. 4a


Fig. 4b


Fig. 4c

**Figs. 4a–c**_Exposure of unerupted tooth 45 with LiteTouch, Er:YAG laser.




**Figs. 5a–c**_Laser gingivectomy of lower left quadrant with LiteTouch, Er:YAG laser.

programmed to 50–75 mJ with a frequency of 10 to 30 Hz. To reinforce the hemostasis, the Erbium laser with energy of 65 mJ is used, frequency of 20 Hz and pulse duration of 600 µs.[3] Figures 4a–c demonstrates a case with exposure of interrupting premolar.

Er:YAG laser is very effective when the impacted tooth is located intra-bony, because it can work on mucosa, gingival and bone at different parameters. The Erbium laser with energy more than 100 mJ and frequency of 20 Hz is used for soft tissue cutting and bone removal.

*Gingival remodelling and gingivectomy*

In children with gingival hypertrophy, we can use various lasers for gingival remodelling. Gingival hypertrophy can be caused by some hydantoin anticonvulsants or other medications.[64] It can be induced during different stages of orthodontic treatment and especially when there is poor oral hygiene. Also, in cases of tooth decay that goes under the gingiva, it's possible to use a laser to remove gingival tissue and proceed through repair stages without gingival haemorrhage. In gingivectomy, Erbium laser can be used at low energy of 55–80 mJ and frequency of 10–20 Hz (Figs. 5a–c). The use of water spray reduces pain and helps tissue cooling. The procedure is usually accompanied by controllable bleeding. A gingivectomy during an orthodontic treatment brings the natural contour of the gingival margin. It makes treatment easier and comfortable both for the patient and the clinician. If the overgrown gingival tissue covers the brackets, it will prolong and trouble the treatment. Gingival remodelling improves the smile line. It is important to preserve the biologic width of the periodontal tissue. The procedure is performed under anaesthesia and the parameters for Er:YAG laser must be reduced to 50 mJ, 10–20 Hz.

Laser therapy offers minimally painful treatment that will not leave negative emotions. The technique is safe, fast and easy to reproduce. The decreased operating time leads to patient's acceptance and early treatment without waiting for further complications.

*Treatment of aphthous ulcers and herpetic lesions*

Aphthous ulcers are very common in children. One of the easiest and most appropriate ways to treat these lesions is the application of a low power laser like the Erbium laser without using local anaesthesia. It is possible to use Erbium laser with frequency of 15 Hz and energy of 35 mJ in a non-contact way. First, the laser is maintained for 15 s on the lesion and then it is moved in a rotation pattern above the lesion. The treatment is prolonged to a 1 mm margin outside the lesion.[66,67] The idea is to detoxify and dehydrate the ulcer as well as to induce bio-stimulating effect.[66]

Herpetic gingivostomatitis is the most frequent oral pathology in small children. A laser treatment with mid-infrared lasers like Erbium laser, allow the evolution of the lesions and consequently instant dehydration. Er:YAG laser effectively stops the pain and makes the treatment procedures shorter in time and less in number. Minimal energy at a low frequency must be used at the beginning of a treatment around the lesion and then towards the centre of the lesion. The white appearance is an indication for a complete dehydration. The procedure it asymptomatic and has a lasting relief.

*Medically compromised conditions*

To provide thorough and safe treatment for medically compromised patients, who cannot tolerate care, dentists must carry out more complex dental treatments for the safety and comfort of the patients. Physically and emotionally exhausting treatments cannot be tolerated by such patients. Naturally, systemically compromised patients quickly discover that they cannot withstand the stress of routine treatment used in conventional dentistry. Therefore, after some unpleasant experiences, patients will only seek dental support when there is an emergency or when they have aesthetic concerns, and they abandon elective complete treatment.[68] The treatment of oral diseases that individuals with systemic conditions receive has a direct impact on their overall health and/or medical therapy, and includes care to control and mitigate pain and infection and the restoration of function. Oral health care is an integral part of systemic treatment.

Providing both primary and comprehensive preventive and therapeutic oral health care to individuals with special health care needs (SHCN) is an integral part of the specialty of paediatric dentistry. Individuals with SHCN may be at an increased risk for oral diseases throughout their lifetime.[69,70] Patients with mental, developmental, or physical disabilities who do not have the ability to understand, assume responsibility for, or cooperate with preventive oral health practices are vulnerable as well.[71] Oral health is an inseparable part of general health and well-being. SHCN

also includes disorders or conditions which manifest only in the orofacial complex (e.g., amelogenesis imperfecta, dentinogenesis imperfecta, cleft lip or palate, oral cancer). While these patients may not exhibit the same physical or communicative limitations of other patients with SHCN, their needs are unique, affect their overall health, and require oral health care of a specialised nature. Dental treatment, using Er:YAG laser therapy helps the dentist even in the field of medically compromised children. It offers the opportunity to fulfil patients' needs fast, painless and effective. The new prospective in preventive dentistry is seen in all the advantages of Er:YAG laser treatment, because with this it became possible to use one appliance in many preventive and therapeutic procedures and thus patients' compliance. Whenever there is prevention the ergonomic effect is obvious because minimally invasion and prevention of complications are worth benefits.

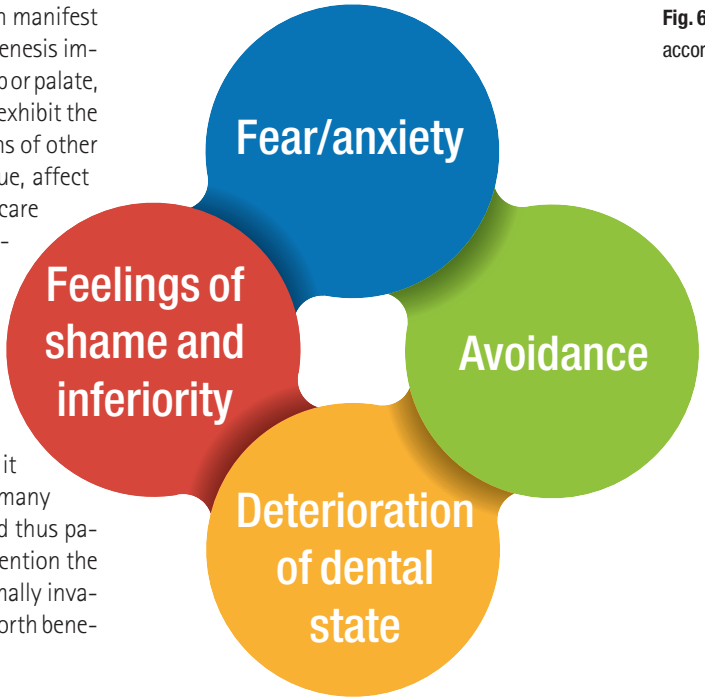



**Fig. 6**_Vicious cycle of dental fear according to Berggren.

## _Patient emotional impact-based situations

The terms dental fear, dental anxiety and dental phobia are currently being used interchangeably in dental literature when referring to negative feelings related to dental treatment. Dental fear represents a normal emotional reaction to a specific external threatening stimulus in a dental situation. Dental anxiety represents a state where the patient is evoked and prepared for something unpleasant, unknown and negative to happen. Dental phobia represents a severe type of dental anxiety, which is characterised by persistent fear of clearly discernible objects and situations and results in avoidance of necessary dental treatment or enduring treatment only with dread.[41] These psychological reactions interfere significantly with daily life. They are problems suffered by many patients worldwide and remain a significant challenge in providing adequate dental care. The aetiology of dental fear and anxiety is multifactorial. The idea of a "vicious cycle of dental fear and anxiety" has been promulgated by several studies to explain the mechanism of their appearance and development. Some researchers posit a role of psychological variables such as embarrassment and feelings of shame culminating in avoidance of dental treatment and deterioration of oral health[34-36] (Fig. 6), whereas Bauma et al. propose that anxiety plays a crucial role in the "vicious cycle of dental fear".[44]

Several studies among Australian dental patients present the role of dental fear as a component in the cycle of dental disadvantages with dentally anxious individuals avoiding dental care. It results in worsening their dental problems and increasing the likelihood that subsequent dental visits will be for emergency reasons. So dental fear feeds back itself as a result of a number of repercussions of the fear. These conceptualisations are described in another model of the so-called "vicious cycle of dental fear" (Fig. 7).[45, 46]

A recent study by van Wijk and Hoogstraten investigated the interaction between anxiety and dental pain. They suggest that people who respond fearfully to pain are at increased risk of ending up in the "vicious cycle of dental anxiety" (Fig. 8).[47] If this cycle is not broken, a severe form of dental anxiety, dental phobia, might develop. So they propose a modification of the "vicious cycle" emphasizing the leading role of the fear of pain in the mechanism of the development of dental anxiety. In view of the above mentioned, it is suggested that dental fear and anxiety result in a delayed and symptom-driven treatment culminating in an avoidance of necessary dental care and deterioration of both oral health and overall health. This linked chain feeds back into the experiences of dental fear and anxiety. Overall, these studies highlight the need for alternative methods in dentistry that will weaken the impact of the main components that nourish and empower the "vicious cycle". Consequently, the proven connection between dental anxiety and pain[48, 49], keeps patients away from the dental practice and thus may frequently result in acute symptoms and complications. The 21st century calls for a different treatment atmosphere and conditions that eliminate the elements constructing the "vicious cycle" of dental fear.

## _Decreasing dental anxiety

Several studies have shown that the most potent triggers for dental anxiety are the sight of the anaes-

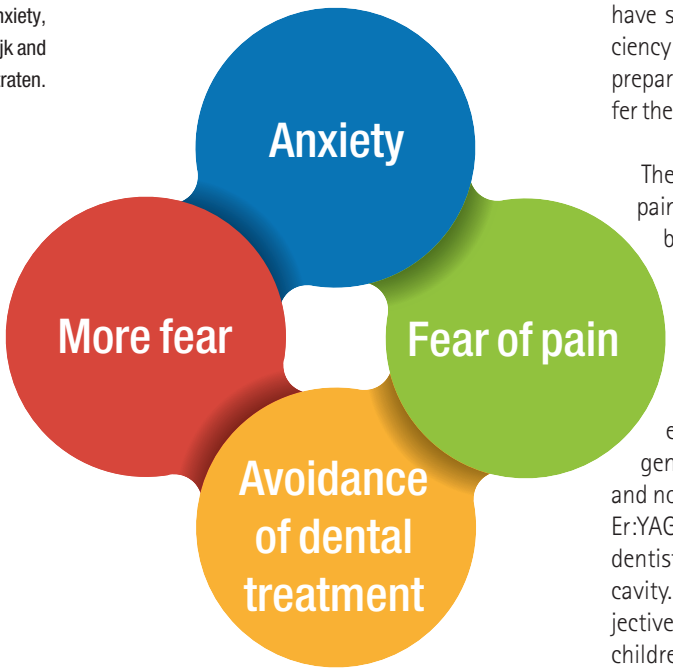



**Fig. 7**_Vicious cycle of anxiety, modified by van Wijk and Hoogstraten.

thetic needle and the sight, sound, smell and vibration of dental handpieces and rotary dental drills, which are pain-associated with dental treatment.[50–52] It has been suggested that reducing these stress-triggers is an effective procedure for managing anxious patients.[48,49] For this reason, anxious patients who must undergo restorative procedures are often managed using the "4S" rule or the so called "4S" principle. It is based on removing four of the major primary sensory triggers for dental anxiety in the dental setting—sight (air turbine drill, needles), sounds (drilling), sensations (high frequency vibrations—the annoyance factor), smells—and it is used in conjunction with other measures and alternative methods to mitigate anxious behaviours and their consequences.[48] A therapy with Er:YAG laser in paediatric dentistry has known advantages, especially for the safety of its use and for its gentle approach with patients.[53] Dental laser treatment reduces the need for injected local anaesthesia and obtains very low to null likelihood of odontoblastic pain and the annoyance factor during carious removal. There is no smell or dentine ablation vapour in case of inadequate suction during cavity preparation. The dominant physical sensation is popping (shock waves) and ablation sound. This new technology offers new possibilities to the paediatric dentists' to completely change restorative treatments and thereby help to decrease dental anxiety of patients.

Numerous studies have been designed to determine the subjective acceptance and pain perception of an Er:YAG laser for soft and hard tissue therapy and to consider the influence of this new technology in case of dental anxiety. As results of several studies on patient acceptance of different methods for cavity preparation have shown, Er:YAG lasers have an acceptable efficiency compared to the conventional mechanical preparation and patients aged ten years and older prefer the alternative method.[54–56]

The analysis of the obtained results from the use of pain assessment scales indicates that patients have been reported no or low pain perception during laser preparation in contrast to the high pain levels during the conventional mechanical preparation. The significant decrease of patient discomfort and dental anxiety have been found to be caused by the painless nature, elimination of the high frequency vibrations generated by the rotary conventional instruments and noncontact mode of lasers. Due to its versatility, Er:YAG is the most frequently used laser by paediatric dentists to treat both hard and soft tissues in the oral cavity. Genovese et al. have been investigated the subjective tolerance and acceptance of laser therapy in children needing both dental and soft tissue treatments.[53] The results show that the hard tissue therapy have been carried out without anaesthesia and with good collaboration of the patients in 90 per cent of the cases. While in the soft tissue therapy the acceptance has been presented in 62 per cent of the treated patients because of the more invasive nature of the procedure. The findings of this study show a total acceptance of 75 per cent of the treated cases. Hence, the comfort registered during the treatment contributes to a decrease of dental anxiety and makes laser techniques a very effective method in paediatric dentistry and a good treatment option for anxious patients. Fear of pain has been strongly linked to the development of dental anxiety and avoidance of dental treatment.[57]

The application of Er:YAG lasers leads to a decrease of dental anxiety by eliminating the main component of the "vicious cycle of dental anxiety" which is pain, and the major stress trigger observing the "4S" rule which are high frequency vibrations. Thus, this technology offers new possibilities for an improved service of anxious patients in both children and their parents. Because nowadays many children may experience laser treatment as their first contact with dentistry, there is a possibility that a new generation of patients will grow up with a different attitude towards dentistry. Parents are also enthusiastic about being able to offer their children the advantages of laser care.[58]

## _Phobic Patients

Dental phobia represents a severe type of dental anxiety, which is characterised by persistent fear of clearly discernible objects and situations and results in avoidance of necessary dental treatment or enduring treatment only with dread.[41] Several studies report that 6-15

per cent of people avoid regular dental care because of dental anxiety and phobia.[59]

The prevalence of general and specific phobias reduces with age.[59] The concept of the "vicious cycle" as mentioned previously is valid for adults and children and adolescents with dental phobia. Surprisingly, among different subtypes of phobias, the dental phobia is the most prevalent (3.7 per cent).[59] These findings should alert both researchers and dental practitioners with the objective to seek for ways of improving this condition. The Diagnostic and Statistical Manual of Mental Disorders distinguishes phobia from fear on the basis of the feared stimulus being avoided or endured with intense distress. Precisely those people report high dental fear, avoidance of visiting the dentist and significant social and functional impacts who meet the criteria for a dental phobia.[45]

Er:YAG lasers can also be used in different paediatric soft tissue procedures, such as frenectomy, operculectomy, exposure of unerupted teeth, some oral pathological conditions including mucocele, fibroma, haemangioma, herpes labialis and aphthous ulcers.[3, 22, 60]

## _Conclusion

The clinical work with Erbium laser is minimally-invasive. Compared to the routine bur drilling where healthy tissue can also be removed, Erbium laser ablation has minimal penetration in hard dental structures. It prevents healthy hard tissues. It reassures bactericidal environment of the treated surfaces and prevents further carious development. Er:YAG is one of the best suited laser types for cavity preparation because of its efficiency, especially in dentin. In addition, important pain reduction in comparison to bur-assisted preparation has clearly been demonstrated to make it possible working without local anaesthesia in most cases. Cavity preparation with Erbium laser has no smear layer and by using it a perfect marginal quality of the sealing material can be realised. Erbium laser can be used successfully in medically compromised children with special needs. As for the emotional side, Erbium laser has good acceptance and gives the opportunity for an attitude transformance, providing right behaviour for prevention. Laser seems to be a promising solution for treatment on time and prevention. Reducing dental anxiety and forms of phobia by using laser therapy sometimes is the only possible way to prevent and treat paediatric patients.

The LiteTouch Er:YAG laser is suitable for minimally-invasive dentistry, and is an ideal tool for cavity preparation in both primary and permanent teeth and in soft tissue management in the field of paediatric dentistry._

*Editorial note: A list of references is available from the publisher.*

## contact

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## Kurz & bündig

Bei der Anwendung weniger invasiver Prozeduren an der Zahnstruktur hat sich die moderne Zahnmedizin lange Zeit auf präventive Methoden und konservative Techniken konzentriert. Das Bewusstsein über die Notwendigkeit, Zahngewebe zu erhalten und eine patientenfreundliche Behandlung durchzuführen, ist mittlerweile selbstverständlich geworden. Eine operative Zahnbehandlung zieht weitere chirurgische und invasive Behandlungen nach sich. Wann immer möglich sollte jedoch Gewebe bewahrt und eine invasive Behandlung auf ein Minimum reduziert werden.

Für eine minimal-invasive Vorgehensweise eignet sich der Erbium-Laser. Verglichen mit dem routinemäßigen Bohrer, mit dem auch gesundes Gewebe entfernt werden kann, wird bei einer Erbium-Laser-Ablation nur minimal in die Hartzahnstruktur eingedrungen. Damit wird gesundes Hartgewebe bewahrt, das bakterizide Umfeld der behandelten Oberfläche sichergestellt und ein Schutz vor einer weiteren Kariesentwicklung gewährleistet. Verglichen mit einer bohrergestützten Präparation konnte bei der Laseranwendung eine deutliche Schmerzreduzierung beobachtet werden, was in den meisten Fällen eine lokale Anästhesie überflüssig macht.

Der Erbium-Laser lässt sich erfolgreich bei der Behandlung von Kindern mit „special needs" anwenden und auch aus psychologischer Sicht stößt er auf große Akzeptanz. Der Er:YAG-Laser ist somit ein ideales Werkzeug für die minimal-invasive Zahnheilkunde und die Kavitätenpräparation sowohl bei Milchzähnen als auch im dauerhaften Gebiss und eignet sich hervorragend für das Weichgewebsmanagement im Bereich der Kinderzahnmedizin.