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Comparison of Diode Laser and Er:YAG Lasers in the Treatment of Ankyloglossia*

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Abstract

Objectives: The purpose of this study was to compare the tolerance of lingual frenectomy with regard to a local anesthesia requirement and comparison of postsurgical discomfort experienced by patients operated on with both diode and erbium:yttrium-aluminium-garnet (Er:YAG) lasers. ***Background:*** Ankyloglossia, commonly known as tongue-tie, is a congenital oral anomaly characterized by a short lingual frenulum. A short lingual frenulum may contribute to feeding, speech, and mechanical tongue problems. ***Methods:*** Sixteen referred patients with tongue mobility complaints were included in this study. A GaAlAs laser device with a continuous wavelength of 808 nm was used in the diode group. Frenulums were incised by applying 2 W of laser power. The Er:YAG laser device with a continuous wavelength of 2940 nm was used in the Er:YAG group. Frenulums were incised by applying 1 W of laser power. The acceptability of the lingual frenectomy without local anesthesia and the degree of the postsurgical discomfort were evaluated. ***Results:*** Although the majority of patients (six) could be operated on without local anesthesia in the Er:YAG group, all patients could not be operated on without local anesthetic agent in the diode group. There were no differences between the two groups with regard to pain, chewing, and speaking on the first or seventh day after surgery, whereas patients had more pain in the Er:YAG group than in the diode group the first 3 h after surgery. ***Conclusions:*** The results indicate that only the Er:YAG laser can be used for lingual frenectomy without local anesthesia, and there was no difference between the two groups regarding the degree of the postsurgical discomfort except in the first 3 h. In conclusion, these results indicate that the Er:YAG laser is more advantageous than the diode laser in minor soft-tissue surgery because it can be performed without local anesthesia and with only topical anesthesia.

Introduction

Ankyloglossia is commonly known as tongue-tie and is a congenital oral anomaly characterized by a short lingual frenulum. A prominent lingual frenulum is commonly seen in infants.[1] However, anecdotal evidence suggests that ankyloglossia may be associated with several social issues, as well as functional limitations in adults.[2] A short lingual frenulum may contribute to feeding, speech, and some mechanical tongue problems.

The diode and erbium:yttrium-aluminium-garnet (Er:YAG) lasers are a relatively new addition to the surgical armamentarium. The diode laser is used almost exclusively for soft-tissue surgery. The erbium laser can be used for hard- and soft-tissue surgeries. Each laser produces different wavelengths and has advantages and risks. The diode laser is a semiconductor that uses solid-state elements (i.e., gallium, arsenide, aluminum, and indium) to change electrical energy into light energy. The light energy from the diode is highly absorbed by the soft tissues and poorly absorbed by teeth and bone.[3] When used in a contact mode, the continuous-wave diode laser at low power is a useful instrument for excising tissues and reducing bacteria.[4] The Er:YAG laser has high absorbance to water and mineral apatite, making it useful and safe for the ablation of hard tissues.[5] However, this laser has also been used for soft-tissue surgery.[4] Both lasers have been approved by the US Food and Drug Administration for treatment in dentistry.

Both children and adults are often frightened by injections or surgical procedures; they also worry about the postsurgical

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period. It has been reported in some literature that laser surgery has more advantages than conventional techniques when comparing postsurgical discomfort after frenectomy.[6,7] The purpose of this study was to compare the tolerance of lingual frenectomy with regard to a local anesthesia requirement and postsurgical discomfort experienced by patients operated on with both diode and Er:YAG lasers.

Materials and Methods

Study population

Sixteen referred patients with tongue-mobility complaints signed the informed consent form and were included in this study, which was approved by the local ethics commission. The 16 patients were randomly divided into two groups: a diode laser group and an Er:YAG laser group (eight patients in each group). The patient population consisted of eight women and eight men aged between 18 and 27 years. Patients with any systemic diseases were excluded from the study, and all operations were performed by the same surgeon.

Surgical procedure

Patients were assigned to treatment with either the diode laser or the Er:YAG laser.

Surgical procedure of diode laser

A GaAlAs diode laser device (Doctor Smile erbium and diode laser, Lambda Scientifica S.r.l, Vicenza, Italy) with a continuous wavelength of 808 nm was used in the diode laser group. After topical anesthesia, frenulums were incised by applying laser with 2-W power via a laser handpiece. The 2-W laser power parameters were chosen based on our clinical experience and the manufacturer's advice. A surgical aspirator was used to cool the operative site (Figs. 1 and 2).

FIG. 2. One-week follow-up after operation with diode laser.

Surgical procedure of Er:YAG laser

The Er:YAG laser device (Doctor Smile erbium and diode laser, Lambda Scientifica S.r.l, Vicenza, Italy) with a continuous wavelength of 2940 nm was used in the Er:YAG laser group. After topical anesthesia, frenulums were incised by applying laser with 1-W power via a laser handpiece. The 1-W laser power parameters were chosen based on our clinical experience and the manufacturer's advice. The operations

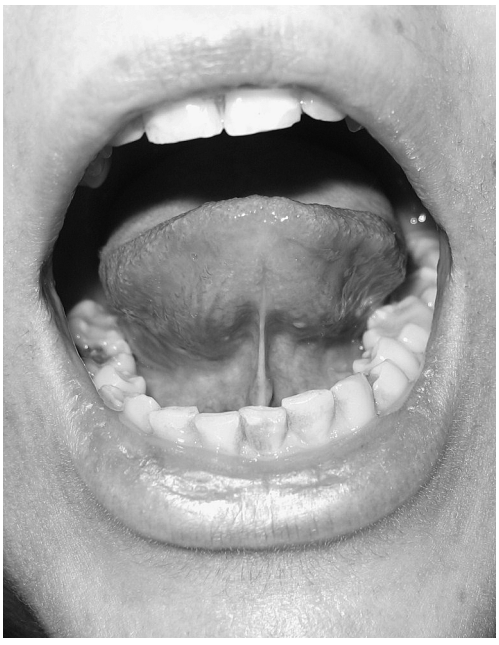

FIG. 1. Preoperative figure of the tongue.

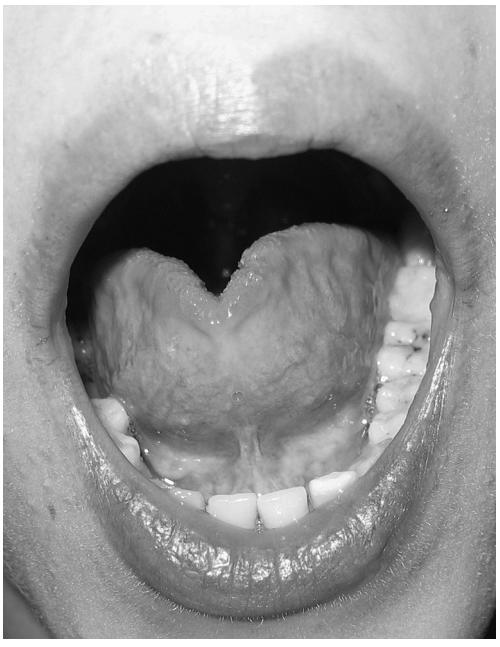

FIG. 3. Figure of the tongue before surgery.

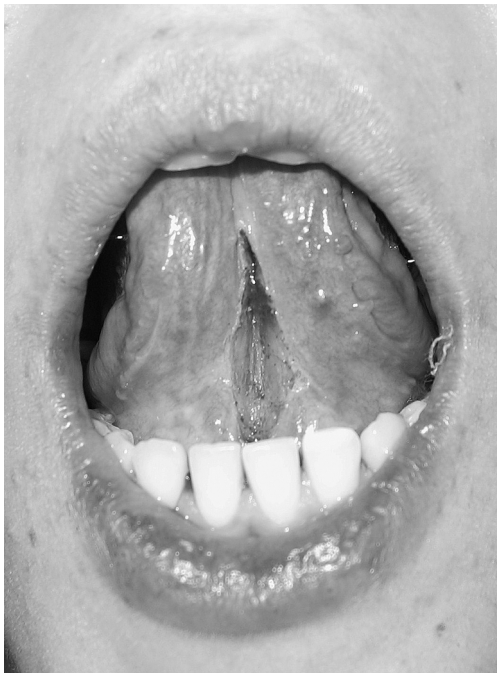

FIG. 4. Postoperative figure of the tongue just after surgery with the Er:YAG laser.

were performed with 80% air spray cooling and without water cooling (Fig. 3, Fig. 4).

The operations were performed initially without local anesthesia in both groups. A 2-mL articaine hydrochloride injection was used when patients reported pain from the surgical procedure. The operations performed without local anesthesia were recorded to determine the patient's tolerance to frenectomy. No sutures were placed after the laser surgeries.

After surgery, each patient was given a form designed to assess his or her recovery in terms of pain and oral function, such as chewing, eating, and speaking. Oral functions were assessed with a 5-point Likert-type scale with anchors of "no trouble" [1] and "lots of trouble" [5]. This survey was repeated on postoperative days 1 and 7 to register the degree of postsurgical discomfort. Data on chewing, eating, and speaking scores were added. The patients' pain levels at the first 3 h after surgery and the patients' worst pain levels over the previous 24 h on postoperative days 1 and 7 were assessed with a 7-point Likert-type scale anchored by the verbal descriptors "no pain" [1] and "worst pain imaginable" [7].[8]

The data were analyzed by Kruskal–Wallis and Mann–Whitney U tests. Changes were considered statistically significant with p values <0.05.

Results

Diode laser group

Two frenectomy procedures were started with topical anesthesia and completed with local anesthesia in the diode laser group. The other six patients were administered local anesthesia because of surgical discomfort.

Er:YAG laser group

During the frenectomy, two patients were anesthetized locally due to surgical discomfort, and six patients were operated on with topical anesthesia only in the Er:YAG laser group (Table 1). The Er:YAG laser patients had more bleeding than the diode laser patients during surgery, but no excessive bleeding was reported.

There were no differences between the two groups with regard to pain, chewing, eating, and speaking on the first or seventh days after surgery. However, patients had more pain during the first 3 h after the operation in the Er:YAG laser group than in the diode laser group (Tables 2 and 3). Only one patient presented with severe pain after 4 h in the diode laser group. None of the patients was found to have any infections during the postoperative healing period. Results of the study are presented in Tables 1–3.

Discussion

The lingual frenulum usually becomes less prominent during the first 2 to 5 years of life as the mandibular alveolus grows and teeth begin to erupt. Management of a tight lingual frenulum is controversial. Surgical consultation is usually sought for the following reasons: feeding and chewing difficulties, airway and respiratory issues, speech problems, or periodontal problems.[1] Treatment of the ankyloglossia can be made by scalpels or lasers.[6,7] Complications historically attributed to frenectomy include infection, hemorrhage from severing of the lingual artery, and asphyxia from the tongue falling back into the airway. In recent years, there has been a renewal of interest in frenectomy as a treatment for ankyloglossia and an exploration of the complications associated with the procedure.[9] There were no major complications during the postoperative healing period in our study. Only one patient presented with severe pain 4 h after surgery in the diode laser group.

Since lasers were introduced for the treatment of oral diseases, there has been considerable advancement in technology. As a result, numerous laser systems are available for oral use: neodymium:yttrium-aluminum-garnet, carbon dioxide, the semiconductor diode, and the Er:YAG.[10] Laser treatment has served as an alternate or adjunct treatment to more conventional therapies because of its many advantages, including ablation or vaporization, hemostasis, and sterilization.[7]

Table 1. The Acceptability of the Lingual Frenectomy without Local Anesthesia

Laser types	*No requirement for local anesthesia during operation*	*Required local anesthesia in the middle of the operation*	*Required local anesthesia at the beginning of the operation*
Diode laser	—	2	6
Er:YAG laser	6	2	—

Table 2. Comparison of the Pain Level After Frenectomy with Diode and Er:YAG Lasers

	Diode laser group (n = 8)		*Er:YAG laser group (n = 8)*		
	Mean	*SD*	*Mean*	*SD*	p
First 3 h	1.50	0.93	3.13	0.64	0.005
1st day	2.25	1.28	2.38	1.19	>0.05
7th day	1.50	0.76	1.75	0.71	>0.05

Table 3. Postsurgical Discomfort (Total of the Chewing, Eating, and Speaking Scores)

	Diode laser group (n = 8)		*Er:YAG laser group (n = 8)*		
	Mean	*SD*	*Mean*	*SD*	p
1st day	5.13	1.36	5.25	1.38	>0.05
7th day	4.12	0.99	4.38	1.06	>0.05

Besides these advantages, we propose that the Er:YAG laser might be used for minor soft-tissue surgery with less local-anesthesia requirement.

An initial comparison of the results from our study indicate that, when compared with a diode laser, the Er:YAG laser is more comfortable because of a lower local-anesthesia requirement. Genovese and Olivi[11] reported that erbium laser treatment has good acceptance and tolerance: a success rate of 90% for hard tissues and 63% for soft tissues. Besides, Olivi et al.[12] have reported removal of fibrous epulis with the erbium laser without anesthetic infiltration. The pain experienced by those operated on in the Er:YAG laser group compared with those in the diode laser group during the first 3 h after surgery may be related to local anesthesia. Two patients were given local anesthesia in the Er:YAG laser group, but all patients were given local anesthetic in the diode laser group. It was concluded that the Er:YAG laser required less local anesthesia in minor soft-tissue procedures.

Soft-tissue procedures cause postsurgical pain and discomfort when chewing, eating, and speaking.[6] In this study, patients were evaluated for pain during the first 3 h and on the first and seventh days after surgery, and for postsurgical discomfort on the first and seventh days after surgery. There were no differences between the two groups with regard to pain, chewing, eating, and speaking on the first and seventh days after the operations. However, the patients had more pain during the first 3 h after surgery in the Er:YAG laser group than the diode laser group. In previous studies, some authors[6,7] compared the differences with respect to patient perceptions after laser and conventional surgical frenectomy and suggested that laser surgical frenectomy was superior to the conventional technique regarding postsurgical discomfort. Haytac and Ozcelik[6] reported that patients treated with a carbon dioxide laser had significantly less postoperative pain and functional complications compared with those who had scalpel surgery. Kara[7] has suggested that neodymium:yttrium-aluminum-garnet laser frenectomy provides better patient perception of success than that seen with conventional surgery. Besides that, we have not observed differences between the two laser groups regarding postsurgical discomfort.

The results indicate that the Er:YAG laser might be used for lingual frenectomy without local anesthetic agents; there was no difference between diode and Er:YAG laser surgery regarding the degree of postsurgical discomfort.

Conclusion

The Er:YAG laser has more advantages than does the diode laser for minor soft-tissue surgery because it very likely can be performed without local anesthesia and used in minor soft-tissue surgery with topical anesthesia.

Author Disclosure Statement

No competing financial interests exist.

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