Original Article

The Role of Laser Stimulation (Electro-acupuncture) in Alginate Impression Making for Patients with a Gag Reflex.

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Abstract

A pronounced gag reflex (GR) is a problem for the acceptance and delivery of dental treatment for children. Despite a range of management strategies, lasers represent a quantum leap forward in the treatment of pediatric dental patients. The aim of this study was to evaluate the effect of low level laser stimulation (electro-acupuncture) in controlling the gag reflex of patients requiring upper alginate impression. Forty-five patients participated in the study, and were divided into three groups (Groups A, B, and C) of fifteen patients in each group. GR assessment was estimated by using the Gagging Severity Index (GSI). Group A underwent a red-light soft magnetic field laser stimulation (electro-acupuncture) on conception vessel 24 (CV 24) for one minute (min). Group B underwent a combination of laser acupuncture of CV 24 and acupressure on pericardium 6 (PC 6). Group C, formed the placebo group. During laser acupuncture and acupressure, a second impression was taken and the Gagging Prevention Index (GPI) was evaluated. Both the GSI and the GPI were recorded at three different stages of the dental impression making procedure, stage I- an empty impression tray, stage II- with a loaded tray, stage- III ability to keep the impression in the mouth until the alginate sets. Statistical analysis was done using the SPSS version 21 software (SPSS Inc., Chicago IL). A significant decrease in GPI values as compared to GSI values, was observed after the laser acupuncture in Group A and B ($p<0.05$). The average improvement between the GSI and the GPI scores before and during laser acupuncture and acupressure in Group B was 53.6 %, in Group A was 34.2 % and in Group C was 2.81 %. When the mean values of GSI and GPI scores of the empty tray, loaded tray, alginate set were compared among the three groups A, B, C before and during laser acupuncture and acupressure, the results were statistically significant ($p<0.05$). The study concluded that both techniques, laser acupuncture on acupuncture points CV 24 and the combination of laser acupuncture on acupuncture points CV 24 and acupressure point PC 6 were effective methods in controlling the gag reflex.

Keywords: Acupressure, gagging prevention index, gag reflex, gagging severity index, laser acupuncture

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Introduction

The gag reflex is a physiological reaction to inhibit foreign objects or harmful material from entering the pharynx, larynx or trachea. It is regulated by nerve endings situated on the soft palate, the pharynx, the pharyngeal part of the tongue.[1] The origin of gagging has been attributed to be either somatic or psychogenic. In somatic gagging, touching a trigger area induces the reflex.[2] Psychogenic gagging is stimulated without direct contact. The sight, sound, smell or even thought of dental treatment is sufficient to induce the gag reflex in some individuals.[1]

The gag reflex sometimes has an undesirable impact on the efficacy of dental procedures such as intraoral examination, making dental impressions and many other clinical dental procedures. There are several methods to control the gag reflex. They include relaxation, distraction, desensitization techniques, psychological therapy, behavioral therapies, local anesthesia, conscious sedation and general anesthesia techniques. They also include complementary medicine therapies comprising of hypnosis, acupuncture and acupressure.[3,4]

The concept of laser acupuncture

Laser acupuncture was first scientifically tested in Graz, Austria. It represents a novel painless, non-invasive acupuncture method. The individual combinations of acupuncture points can be stimulated simultaneously as in traditional Chinese medicine.[9] Laser acupuncture with different wavelengths have been used in several areas, including for the treatment of headaches[10], chronic maxillary sinusitis in children[11], anesthesia for minor operations[12], therapy relating to the acute obstruction in asthmatic children[13] and vomiting.[14]

A red-light soft laser (power output 2.5W-5W, wavelength 810 nm) was used which had a pulsating magnetic field of 9 Hz with a penetration depth of 30 cm was used for acupuncture. A red-light soft laser stimulates the organism's bioenergetic regulation processes on the cellular level.[9] Litscher[9] investigated the peripheral effects of acupuncture using a continuous laser light at a wavelength of 685 and 785 nm. A noteworthy increase was observed in peripheral temperature during laser acupuncture.

The stimulation of acupuncture points has been defined as the insertion of a solid needle into specific parts of the human body for disease prevention, therapy or the maintenance of health. Acupuncture points on the body are stimulated by needles, pressure (acupressure), vacuum (cupping), laser or electrical stimulus (electro-acupuncture).[5]

Acupuncture points have been utilized as an alternative method to control the gag reflex. Several acupuncture points including pericardium 6 (PC 6)[6], located on the forearm and conception vessel 24 (CV 24)[7], located in the labio-mental fold on the chin have been used to control the gag reflex. The laser acupuncture of acupuncture point CV 24 and acupressure on PC 6 was found to be an effective method in the treatment of orthodontic patients with gag reflex.[8] The utilization of needle acupuncture in children is a very arduous procedure since it is an invasive technique. However, laser acupuncture and acupressure are painless and more felicitous for children.

The aim of this present study was to evaluate the role of laser stimulation in alginate impression making for patients with a gag reflex (GR). The objective of this study was to compare and contrast the effects of two approaches in patients having GR requiring dental impression of maxillary arch. First approach involves the laser acupuncture (Elexxion AG- Dental Laser, Germany) of the CV 24 acupuncture point. The second consists of a combination of the laser acupuncture of CV 24 acupuncture point and acupressure on PC 6 using wristbands.

Materials and methods

Ethical clearance was obtained from the Institutional Review Board of Terna Dental College, Navi

Mumbai (Protocol number - TDC/IRBEC/121/2016). A total of 45 (28 female, 17 male) children aged 6 to 12 years participated in this study. The sample size was determined according to a previous study.[8]

The patient inclusion criteria were as follows:

1. Patients with moderate (Grade III) to severe gagging (Grade IV) according to the gagging severity index (GSI)[15]
2. Inability to accept dental treatment on a previous occasion due to severe gag reflex.
3. Patients requiring upper alginate impression for diagnostic purpose.
4. Parents of the patient who were able to give informed consent.

The patient exclusion criteria were as follows:

1. Frankl behaviour rating 1 and rating 2.
2. Children with special health care needs.

Patients were randomly divided into three groups: A, B and C. Fifteen patients were present in each group. In all the three groups, a dental impression of the maxillary arch was made with alginate impression material (Prime dental products, India) before and during laser acupuncture and acupressure. The alginate was prepared for 1 min 50 second (s) according to the manufacturer's instructions and the tray was inserted into the mouth where it was kept for 45 s.

Gagging Severity Index (GSI)[15] was used to measure the severity of gag reflex in all the treatment groups before the application of laser acupuncture and acupressure. Gagging Prevention Index (GPI)[15] was used to evaluate the effectiveness of the laser acupuncture and acupressure after the procedure. GSI and GPI were recorded at the three stages at the impression taking procedure:

- Stage I evaluation of the patient's ability to tolerate an empty tray (placed in the mouth).
- Stage II evaluation of the patient's ability to tolerate a loaded tray (placed in the mouth).
- Stage III evaluation of the patient's ability to tolerate the impression in the mouth until the alginate set.

Group A underwent laser acupuncture of CV 24 for 1 min (Fig 1). The laser used in this study was Elexxion AG- Dental Laser (Germany, Output level- 100mW, frequency- 20,000Hz, wavelength- 810nm.) The CV 24 acupuncture point was marked just below the mentolabial sulcus along the midline. While the loaded tray was inserted into the mouth, laser acupuncture was applied simultaneously to acupuncture point CV 24 for 1 min. The laser probe was applied at a distance of 1 cm from the patient.

All results were recorded onto the patient's recording forms.

Figure 1 *A. The acupuncture point conception vessel 24 (CV 24). B. View of use of laser acupuncture on acupuncture point CV 24 .*

Group B patients were subjected to a combination of laser acupuncture of CV 24 and acupressure on PC 6 (Fig 2). The location of acupressure point PC 6 was determined in terms of cuns. (unit of measurement of acupressure

point according to Chinese medicine). 1 cun is the equivalent to the width of the patient's thumb across the interphalangeal joint above the horizontal fold at the root of the hand. The acupressure point PC 6 was marked 3 cuns from the root of the hand. The patients wore a band (Aktive Life Motion Sickness Relief Band, India) on the acupressure point PC 6 point for 20 min before the impression was made. The laser acupuncture of the CV 24 acupuncture point was then performed for 1 min while making impressions in this group and the data was recorded.

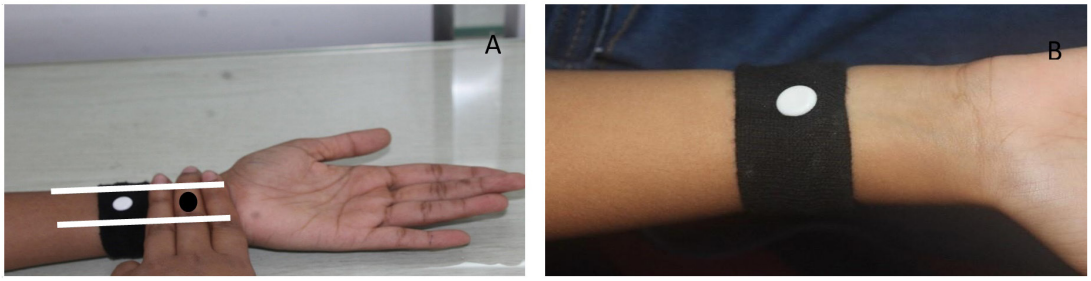

Figure 2 *A The acupressure point PC 6. B. The button on the band was placed over the PC 6*

Group C was the placebo group, the location of the placebo point was on the forearm measuring 6 cuns from the wrist of the patient. According to traditional Chinese medicine, the chosen placebo point is used for treating circulatory disorders in the upper extremity.[9] Laser acupuncture was applied on the placebo point and impressions were made. The placebo point was selected different from acupuncture point CV 24 and acupressure point PC 6 to check efficacy of laser acupuncture on a point which is different from an acupuncture/acupressure point which does not have any gag reflex effect.

Figure 3 *The location of the placebo point. (Forearm)*

Statistical analysis was done using the SPSS (SPSS Inc., Chicago IL) version 21 software, GSI and GPI scores were evaluated by the Paired *t* test. Intergroup comparison was done by one-way Anova test. Intragroup comparisons were evaluated by Post hoc Bonferroni test. The statistical significance level was determined at $p<0.05$.

Results

The GSI and GPI scores of groups A, B, C are presented in Tables 1, 2 and 3 respectively. Comparing GSI and GPI scores at each stage, GPI scores were lower than GSI scores for both Group A and B. Statistically significant data was observed at stage I in Group A and

Group B (p<0.05). On intergroup comparison, mean values of GSI scores among three groups A, B, C before the procedure were statistically significant at stage II, III (p<0.05) (Table 4). On comparison of the mean values of GPI scores with all the three groups after the procedure, it was observed that mean values are reduced than GSI scores in group B at stage II but it was not statistically significant (Table 5). When the mean values GPI scores were compared among three groups A, B, C during laser acupuncture and acupressure after the procedure, results were statistically significant at stage III (p<0.05) (Table 5). It was calculated that there was a marked increase in percentage improvement between the GSI and GPI scores before and during laser acupuncture and acupressure in Group B (53.6 %) as compared to those of Group A (34.2 %). 2.81 % average improvement was seen in Group C. The average improvement was highest in Group B (Table 6).

Table 1 *The results of GSI and GPI scores in Group A.*

Stages	GSI		GPI		*P*
	Mean	SD	Mean	SD	
Stage I (Empty tray)	2.6667	0.84515	2.3333	0.48795	0.000
Stage II (Loaded tray)	3.3333	0.48795	2.4667	0.51640	0.500
Stage III (Alginate set)	3.2667	0.45774	2.3333	0.51640	0.616

SD: Standard deviations, n = 15 (p<0.05).

Table 2 *The results of GSI and GPI scores in Group B.*

Stages	GSI		GPI		*P*
	Mean	SD	Mean	SD	
Stage I (Empty tray)	3.000	0.84515	2667	0.59362	0.000
Stage II (Loaded tray)	2.6000	0.50709	1.9333	0.25820	0.234
Stage III (Alginate set)	2.6000	0.50709	1.3333	0.48795	0.297

SD: Standard deviations, n = 15 (p<0.05).

Table 3 *The results of GSI and GPI scores in Group C.*

Stages	GSI		GPI		*P*
	Mean	SD	Mean	SD	
Stage I (Empty tray)	2.8000	0.86189	2.9333	0.79881	0.00
Stage II (Loaded tray)	3.0667	0.70373	3.0000	0.00000	-
Stage III (Alginate set)	3.0000	0.37796	2.9333	0.25820	0.02

SD: Standard deviations, n = 15 (p<0.05).

Table 4 *Intergroup comparison at stage I, II, III before laser acupuncture and acupressure in all the groups (Empty tray, loaded tray, alginate set) (N- 15)*

	Stage I			Stage II			Stage III		
Groups	Mean	SD	*P*	Mean	SD	*P*	Mean	SD	*P*
A	2.6667	.81650		2.3333	.48795		2.1333	.51640	
B	3.0000	.84515	.555	2.6000	.50709	.004	2.6000	.50709	.001
C	2.8000	.86189		3.0667	.70373		3.0000	.37796	

Table 5 *Intergroup comparison at stage I, II, III during laser acupuncture and acupressure in all the groups (Empty tray, Loaded tray, alginate set) (N- 15)*

	Stage I			Stage II			Stage III		
Groups	Mean	SD	*P*	Mean	SD	*P*	Mean	SD	*P*
A	2.3333	.48795		2.3333	.48795		2.1333	.51640	
B	2.2667	.59362	.012	2.2667	.59362	.012	1.3333	.48795	.000
C	2.9333	.79881		2.9333	.79881		2.9333	.25820	

Table 6 *Percentage improvement (%) between GSI and GPI scores before and after the acupuncture in the groups*

	Group A	Group B	Group C
Stage I	14.60	32.00	4.44
Stage II	35.00	34.00	2.00
Stage III	53.00	95.00	2.00
Average improvement	34.20	53.66	2.81

Discussion

The procedure of making a dental impression in children with gag reflex may pose a challenge to the dentist. Various methods have been proposed to manage the gag reflex.[3,9] Ansari[16] suggested a secondary impression with injection type polyvinyl siloxane in a custom tray which does not stimulate the gag reflex. Friedman[17] have also proposed that training the patients to extend their tongue may reduce the gag reflex by transferring the point of stimulus to the tongue tip. Other studies have suggested that acupressure on the PC 6 point using a wrist band is an effective method in the prevention of nausea. Vachiramon and Wang[18] have also stated that digital pressure on acupressure point CV 24 point is an effective technique to reduce gag reflex. Schlager[14] investigated the effect of 670 nm low-level lasers on the acupuncture point PC 6 in children with vomiting after strabismus surgery. They found that laser stimulation of acupuncture point PC 6 reduced the incidence of vomiting. Dune *et al.*[20] pursued to determine acustimulation (AS) effects on postoperative nausea and vomiting in children. They undertook a meta-analysis to include acupressure, acupuncture and electrical stimulation (ETS). This meta-analysis stated that acupressure and acupuncture are effective treatment modalities in reducing postoperative vomiting in children.

The effect of laser acupuncture of the acupuncture

point CV 24 and combination of acupressure and laser acupuncture on CV 24, PC 6 respectively was evaluated in this study. PC 6 was chosen as an acupressure point. The reason for the usage of both CV 24 and PC 6 in Group B was to investigate whether the two points have a synergistic effect.

Significant reduction in gag reflex in Groups A, B was observed, at stage I ($p<0.05$) (Table 1). Although on intragroup comparison in groups B and C, mean values of GPI scores were less than GSI scores at stage II and III but they were not statistically significant (Table 2, 3). A similar study was conducted by E Sari and T Sari[7], who stated that in all the three stages, GPI scores were less than GSI scores and difference was statistically significant ($p<0.05$). In Group B, it was also observed that at stage II and III initially the patient felt mild gag for about 10-20 seconds but once laser acupuncture was initiated the gag reflex reduced as it was continued till 1 min. Marked reduction in gag reflex was observed in Group C at stage I (Table 3). The decrease in the GPI scores in Group C may due to on psychological factors. Note that psychological and behavioral therapies are one of the methods are effective in controlling gag reflex.[3,4]

Previous studies have presented that CV 24 and PC 6 were effective acupuncture points in patients with gag reflexes. Compared to needle acupuncture, acupressure and laser acupuncture allowed a less painful stimulation, hence acupressure and laser acupuncture were considered in this study. A low-level laser has no known side effects. Laser irradiation on the body can have side effects such as increased pain sensation on the operating area, increased fatigue, drop of blood pressure and vertigo if the site is close to vessels.[19] But in this study, none of the above-mentioned side effects were observed in patients undergoing laser acupuncture.

The mode of action in controlling the gag reflex through acupuncture is not completely understood. It occupies the spectrum of the gag reflex from the mild end of nausea to the severe end which results in vomiting. Vomiting center controls the gag reflex. Although more recent studies have proposed that multiple brainstem sites intervene the act of vomiting and no isolated center exists.[21,22] The most likely cause of a somatically induced gag reflex during dental treatment is the activation of trigger zones in the posterior region of the oral cavity, which are innervated by the glossopharyngeal nerve (IX). On the contrary, the anterior part of oral cavity is supplied by trigeminal nerve (V), which is not considered to take part in the gag reflex. However, there are close connections in the points between the cranial nerves V, IX, and X.[21] After both stimulation of acupuncture point CV 24 and PC 6, the impulses ascend to centres in the mid-brain, towards the nucleus of the raphe magnus (nRm). The nucleus of the raphe magnus is the main source of serotonin (5-HT) in the brain[22] which is metabolised to β-endorphine, which may have an anti-emetic function. It has been shown that acupuncture accelerates the synthesis of 5-HT and it is likely that the serotonin mechanism takes part in the control of the gag reflex. It could be concluded that both points CV 24 and PC 6 have a synergistic effect because it was found that there was an increase in the percentage improvement between GSI and GPI in Group B compared to the results of Group A and C.

Conclusion

The laser acupuncture on acupuncture point CV 24 and combination of laser acupuncture on CV 24 acupuncture and acupressure on PC 6 was found to be effective in controlling the gag reflex in old patients who are 6-12 years old.

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