Journal of Chemical Health Risks

www.jchr.org

JCHR (2025) 15(3), 2709-2714 | ISSN:2251-6727

Evaluating the Effect of Laser Acupuncture on Hegu Acupoint for Managing Gag Reflex and Anxiety in Pediatric Patients Aged 6-10 Years

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(Received Date: 12/04/2025 Revised Date: 08/05/2025 Accepted Date: 21/06/2025)

KEYWORDS
Low-Level Laser Therapy, Hegu Acupoint, Gag Reflex, Pediatric Dentistry, Anxiety Management, Acupuncture

ABSTRACT:

Introduction: Managing gag reflex and anxiety in pediatric dentistry, especially during maxillary impressions, is challenging. Traditional methods like behavioural techniques, sedation, and anaesthesia have limitations or risks. Acupuncture and acupressure offer alternative approaches, but needle-based acupuncture may be unsuitable for children. Low-level laser therapy (LLLT) provides a non-invasive, painless option by stimulating acupoints. This study evaluates the effectiveness of LLLT at the Hegu (LI4) acupoint in controlling gag reflex and anxiety in pediatric patients.

Material and Methods: Forty children aged 6–10 years with a hyperactive gag reflex (Gagging Severity Index score 3–5) were randomly divided into two groups: Group A received no treatment followed by LLLT, while Group B received LLLT first, then a control impression. Triple blinding was applied to participants, clinicians, and assessors. Pulse rate, oxygen saturation, and anxiety levels (usingModified Child Dental Anxiety Scale) were recorded.

Results: Group A showed a significant reduction in pulse rate, anxiety scores, and gagging severity after LLLT ($p = 0.001$), while Group B experienced increased anxiety and gagging severity after LLLT was stopped. Oxygen saturation remained unchanged ($p > 0.05$).

Conclusion: LLLT is a safe, non-invasive, and painless alternative to traditional anti-gagging methods, promoting better compliance in pediatric dental procedures.

Introduction

In dentistry, making impressions is a vital initial step, but ensuring patient compliance can be particularly challenging, especially with pediatric patients. Beyond facilitating communication and reducing fear and anxiety, compliance is essential for delivering high-quality dental care, building a trusting relationship between the dental team, the child, and the parent, and promoting a positive attitude towards oral health in children.

Many patients experience a hypersensitive gag reflex when having alginate impressions taken of their upper

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(3), 2709-2714 | ISSN:2251-6727

arch. This gagging reflex serves to protect against foreign objects entering the mouth and oropharynx.[1] Gagging can be categorized into psychogenic or somatic. Somatic gagging occurs when specific areas in the mouth, like the palate or the sides of the tongue, are stimulated. Conversely, psychogenic gagging can happen without any physical contact, as just thinking about dental procedures can trigger the reflex. Compromised gag reflexes can impact all areas of dentistry, leading to delays during appointments, discomfort for the dental staff and patients, and potential cancellations. This can worsen patients' anxiety and hesitation to seek dental care.[2,3] A variety of strategies have been suggested to manage the gag reflex, such as desensitization techniques, distraction strategies, and relaxation exercises; behavioural and psychiatric interventions; conscious sedation, local anesthetics, and general anaesthesia; and alternative treatments like hypnosis. Additionally, acupuncture has been found effective in modulating the gag reflex through the insertion of fine needles into specific points in the body for therapeutic, preventive, or overall health benefits. These acupuncture points can also be activated using methods like electrical stimulation, cupping, acupressure, or needle insertion.[4,5]

However, due to the invasive nature of needle acupuncture, it presents significant challenges with pediatric patients. Therefore, LASER acupuncture has emerged as painless alternatives that improve patient compliance. Traditional Chinese medicine teaches that the body contains 14 meridians through which energy flows, and stimulating specific points (Qi) along these meridians can have targeted effects.[6] Several anti-gagging points have been identified, such as Conception Vessel 24 (CV24), HeGu point (Li4) in the large intestine, and Pericardium 6 (PC6).[7,8] The PC6 point is located on the inner forearm, just below the palm, and is about the width of one horizontal finger. Given the limited research available on this subject, this study investigates the impact of low-level laser therapy applied to the HeGu acupoint (Figure 1) in managing gag reflex and anxiety among pediatric patients.

Methodology

This research was conducted as a randomized, crossover, double-blind clinical trial aimed at evaluating the impact of low-level laser therapy (LLLT) on the gag reflex during maxillary impression procedures, targeting the Hegu acupressure point (Figure 1). It aligned with the CONSORT guidelines for randomized clinical trials and upheld the ethical principles stated in the Declaration of Helsinki. Approval was obtained from the Institutional Ethical Committee at Inderprastha Dental College and Hospital, Sahibabad, and written informed consent was secured from the parents or guardians of all participating children prior to their enrolment in the study. Using G*Power (version 3.1.2), an effect size of 0.419 was calculated with 80% power, a 95% confidence interval, and a 5% margin of error. Based on these parameters, a sample of 40 children aged 6 to 10 years was recruited. These participants were selected according to specific inclusion and exclusion criteria to undergo maxillary arch impressions. Eligible participants were those without systemic conditions, exhibiting a hyperactive gag reflex with a Gagging Severity Index score of 3–5 (as evaluated by Dickinson's criteria), with written consent provided by their guardians. Children with special healthcare needs, uncooperative behaviour, or whose guardians declined consent were excluded. A computer-generated randomization sequence randomly assigned participants to two groups, Group A and B (Figure 2). A crossover design was employed to reduce interindividual variability and ensure each participant acted as their control. The initial maxillary impressionwas taken without intervention in Group A (n = 20). After a 30-minute pause, LLLT was applied to the Hegu acupuncture point, where Diode LASER (Figure 3) with power output 0.5 mW, wavelength 940 nm, energy 4J, with a penetration depth of few millimeters in a defocused continuous mode was applied on Heguacupressure point keeping the tip of diode LASER 3-4 mm away with 1 inch spot size for 1 minute (Figure 4) followed by a second impression. In the next appointment after 1 week,the procedure was reversed in Group B (n = 20); the first impression was made immediately after LLLT application, followed by a second impression taken 30 minutes later without laser stimulation(Figure 5). To achieve triple blinding in the study, various measures were implemented: the children were unaware of whether they received active LLLT or a sham treatment since identical laser positioning and handling were utilized in both situations. The clinician performing the impressions (secondary investigator) was unaware of the participants' intervention status, while a different researcher administered the laser

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(3), 2709-2714 | ISSN:2251-6727

treatment. The outcome assessor (primary investigator) measuring physiological parameters (pulse rate, oxygen saturation) and anxiety levels (using the Faces version of the Modified Child Dental Anxiety Scale) was also blinded to group assignments. The data analyst dealt with coded datasets devoid of group identifiers for objective statistical analysis. Throughout the impression procedures, physiological parameters like pulse rate and oxygen saturation were recorded using a pulse oximeter. Anxiety levels tied to the gag reflex were assessed via the Faces version of the Modified Child Dental Anxiety Scale. Evaluations were carried out at baseline and during both impression procedures. Data was recorded using Microsoft Excel (version 2007) and analyzed with SPSS software (version 27). Descriptive statistics calculated the mean and standard deviation for continuous variables and proportions for categorical variables. Paired t-tests and Wilconxon signed rank test were leveraged for inferential statistics to compare mean proportions between groups, with statistical significance set at $p < 0.05$.

Figure 1: Representation of Hegu (LI4) acupuncture point

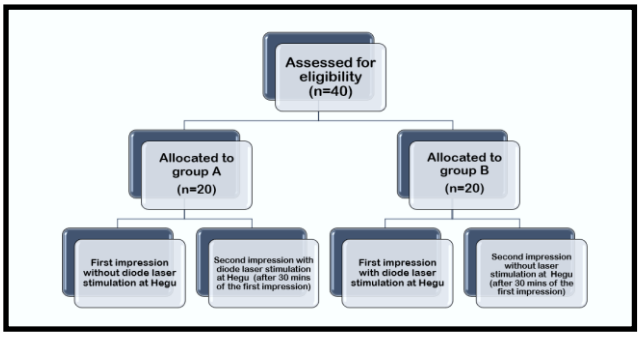

Figure 2: Study design

Figure 3: DIODE LASER

Figure 4: Low-level LASER therapy on Hegu (LI4) acupuncture point

Figure 5: While taking upper impression

Results

This study's findings revealed that low-level laser therapy (LLLT) applied at the Hegu acupressure point

Journal of Chemical Health Risks
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JCHR (2025) 15(3), 2709-2714 | ISSN:2251-6727

effectively manages gag reflex and anxiety in children in whom maxillary impressions were made. In Group A, where the first impression was made without prior laser treatment and the second with it, there was a highly significant decrease in pulse rate (p = 0.001, HS) after laser acupuncture, indicating a relaxation effect by LLLT. Moreover, anxiety scores (p = 0.001) and gagging severity (p = 0.001, HS) showed highly significantreduction following LLLT, demonstrating its success in alleviating discomfort and reflex responses. SpO_2 levels, however, remained stable (p = 0.587, NS), showing no impact on respiratory function. In Group B, where the first impression was made with prior laser treatment and the second without it, the lack of laser treatment led to a highly significant rise in anxiety (p = 0.001, HS) and gagging severity (p = 0.001,HS). This confirmed the vital role of LLLT in managing these factors. Unlike Group A, pulse rates in Group B did not show a statistically significant change (p = 0.655, NS), suggesting individual differences in physiological responses to LLLT. Just like in Group A, SpO_2 levels remained consistent (p = 0.500, NS), supporting that LLLT does not influence oxygen saturation. Overall, these results illustrated that LLLT effectively reduces anxiety and gag reflex severity while preserving respiratory function. The crossover study design enhanced the credibility of these outcomes, as symptoms escalated when LLLT was absent. This evidence advocates for LLLT as a non-invasive and efficient method for addressing gag reflex and anxiety in pediatric dental treatments.

Table 1: Descriptive Analysis of SPO2, Pulse rate, anxiety and Gagging for Group A

Metric	Spo2[a]		PR[a]		Anxiety[b]		Gagging[b]	
	1st Impression	2nd Impression	1st Impression	2nd Impression	1st Impression	2nd Impression	1st Impression	2nd Impression
Mean (SD)	97.85 (2.43)	98.20 (1.11)	101.85 (6.76)	88.95 (9.25)	4.30 (0.66)	1.40 (0.50)	3.90 (1.07)	1.35 (0.49)
Median (Range)	98.5 (88-99)	99.0 (96-99)	102.0 (85-113)	87.0 (80-123)	4.0 (3-5)	1.0 (1-2)	4.0 (1-5)	1.0 (1-2)
Mode (Min-Max)	99 (88-99)	99 (96-99)	101 (85-113)	87 (80-123)	4 (3-5)	1 (1-2)	4 (1-5)	1 (1-2)
Variance	5.92	1.22	45.71	85.52	0.43	0.25	1.15	0.24
P value	0.587,NS		0.001*, HS		0.001*, HS		0.001*, HS	
[a]Paired t test, [b]Wilcoxon signed rank test								

Table 2: Descriptive Analysis OF SPO2, Pulse rate, anxiety and Gagging for Group B

Metric	Spo2[a]		PR[a]		Anxiety[b]		Gagging[b]	
	1st Impression	2nd Impression	1st Impression	2nd Impression	1st Impression	2nd Impression	1st Impression	2nd Impression
Mean (SD)	98.95 (1.19)	98.50 (2.37)	91.40 (9.63)	92.70 (7.77)	1.40 (0.50)	4.35 (0.67)	1.60 (0.50)	3.40 (1.31)
Median (Range)	99.0 (97-101)	99.0 (89-100)	90.5 (82-125)	89.0 (84-115)	1.0 (1-2)	4.0 (3-5)	2.0 (1-2)	3.5 (1-5)
Mode (Min-Max)	100 (97-101)	99 (89-100)	91 (82-125)	88 (84-115)	1 (1-2)	4 (3-5)	2 (1-2)	3 (1-5)
Variance	1.42	5.63	92.78	60.33	0.25	0.45	0.25	1.73
P value	0.500,NS		0.655,NS		0.001*, HS		0.001*, HS	
NS- Non Significant, HS- Highly Significant, [a]Paired t test, [b]Wilcoxon signed rank test								

Discussion

A strong gag reflex poses a considerable obstacle in pediatric dentistry, frequently requiring sedation or general anaesthesia for effective treatment. Even standard procedures, such as making maxillary impressions, can elicit heightened stress, excessive salivation, tears, and occasionally, vomiting. Various approaches, including distraction methods, hypnosis, and sedatives, have been utilized to manage the gag reflex, yet none have proven consistently effective. Acupuncture and acupressure have surfaced as promising alternatives, targeting specific nerve points to reduce discomfort and reflex actions.[9,10] The literature has well-documented the success of acupuncture in

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JCHR (2025) 15(3), 2709-2714 | ISSN:2251-6727

minimizing nausea, anxiety, and gag reflex. Traditional acupuncture involves inserting solid needles into specific nerve points, activating pain-suppressing pathways in the central nervous system, as explained by the Gate Control Theory of Pain (Melzack and Wall, 1960s). This technique inhibits incoming pain signals, easing discomfort and reflexive actions. Additionally, trigger-point stimulation promotes blood flow and oxygen delivery, reducing muscle tension and fostering relaxation.[11,12] LLLT, or "needleless acupuncture," operates through light absorption and biomodulation rather than through the mechanical micro-trauma caused by needles. Photons from low-intensity lasers stimulate specific acupressure points, leading to the release of endorphins and enkephalins, which alleviates pain and promotes neuromodulatory effects. The efficacy of laser acupuncture has been supported by magnetic resonance imaging (MRI) studies, which reveal brain activation patterns that resemble those of traditional acupuncture.[13,14] While earlier studies have primarily concentrated on PC6 and CV24, our research focused on the Hegu (LI4) point. Our study significantly enriched this expanding body of research by demonstrating that LLLT applied to the Hegu (LI4) acupressure point notably decreased gagging severity ($p = 0.001$) and anxiety levels ($p = 0.001$) in pediatric patients. Moreover, our results indicate that LLLT did not significantly affect SpO_2 levels ($p = 0.587$, NS), supporting its safety and non-invasive character. Unlike some traditional acupuncture methods that necessitate needle insertion, LLLT offers a painless, child-friendly alternative, making it especially suitable for pediatric dental practices. The research by Sari and Sari (2010) investigated laser stimulation of CV24 (Conception Vessel 24) and acupressure at PC6 (Pericardium 6) in orthodontic patients with pronounced gag reflex. Their results showed a significant decrease in gagging severity during impressions ($p<0.05$), with Group B (combining CV24 and PC6 stimulation) achieving a 58.9% improvement compared to 37.9% in Group A (CV24 alone) and 11.2% in the placebo group. These findings support our conclusion that targeted laser stimulation of specific acupressure points can effectively mitigate the gag reflex, enhancing patient compliance.[15] Mosannen et al (2022) showed that Gagging Severity Index (GSI), Subjective Severity of Gag Reflex (SSGR), Vomiting Number (VN), significantly improved ($P \leq .05$) in the intervention group compared to the control group, but GSI was higher in the intervention group. In the intragroups analysis for the comparison between before and after the intervention, it was found that although the average GSI was elevated after the intervention rather than before, the difference was insignificant ($P = .083$). Also, after the intervention, the average SSGR was significantly reduced ($P< .001$), and VN was insignificantly lessened ($P =.334$). Moreover, it was observed after the intervention rather than before that GSI was significantly increased ($P< .001$), whereas SSGR significantly declined ($P< .001$), and VN meaningfully decreased ($P = .001$). The observations demonstrated that the Improvement Index status was significantly better in the intervention group compared to the control group ($P = .002$).[16]Fiske and Dickinson's research, which indicated significant improvements in gag reflex tolerance with ear acupuncture stimulation in 8 out of 10 patients. These insights reinforce our results, highlighting that non-invasive stimulation of designated acupressure points can relieve discomfort related to the gag reflex.[17] Bilello and Fregapane (2014) investigated the role of acupuncture in controlling gag reflex among 20 patients aged 19 to 80 years who experienced severe gagging during dental impressions. Their outcomes mirrored ours, indicating that acupuncture could serve as a viable alternative to conventional anti-gagging methods. [18]Additionally, Zotelli et al. (2014) studied the impact of PC6 (Neiguan) acupuncture on controlling nausea during intraoral impressions with 33 adult volunteers, finding that real acupuncture at PC6 significantly decreased nausea, demonstrating the effective and objective nature of acupuncture for reflex suppression.[19] Although our study targeted LLLT applied to LI4, these results underscore the clinical importance of acupuncture-related interventions in dental scenarios. Further validation of LLLT's effectiveness in managing the gag reflex was presented by PaloniKoticha et al. (2021), who compared LLLT alone versus in combination with acupressure in children undergoing impression-making. Their findings concluded that LLLT, whether used alone or with acupressure, significantly outperformed acupressure alone, aligning with our results showing considerable relief for pediatric patients suffering from severe gag reflex.[10] The crossover study design applied in this research bolsters the strength of these results, as it allowed patients to act as their own controls, improving

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internal validity by addressing intersubject variability and enabling a more accurate evaluation of the potential effects of LLLT on reducing gag reflex during dental procedures.

Conclusion

The findings suggest that LLLT at the Hegu acupressure point represents a viable, non-invasive solution for managing gag reflex and anxiety in pediatric dental treatments. Given its effectiveness, safety, and ease of application, laser acupuncture stands out as a promising alternative to sedation or pharmacological interventions, representing an invaluable resource in pediatric dentistry. Future studies should investigate long-term effects, optimal laser parameters, and comparative analyses with other acupuncture points to strengthen the validity of these findings.

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