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# Effect of Low-Level Laser Therapy in Managing Anxious Children Aged 8-12 Years Before and After Administration Of Local Anaesthesia: A Clinical Trial

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***Abstract: Background:*** *Laser acupuncture, a pain-free alternative to traditional needle acupuncture, has shown promising results in treating various dental conditions.* ***Aim****: To evaluate the effectiveness of LLLT in managing anxious children of age 8-12 years before and after administration of Local Anaesthesia.* ***Methodology:*** *The level of anxiety in patients were asked to report by pointing to the face that best represents their level of fear using the Faces version of the Modified Child Dental Anxiety Scale, and the pulse and heart rate were recorded using a pulse oximeter before administration of local anaesthesia. Then LLLT acupuncture was performed on and off mode at acupoint Baihui (GV 20), followed by local anaesthesia administration. Then the level of the anxiety of the patient was evaluated and compared.* ***Results:*** *At baseline, both groups had similar values across all parameters. Post-intervention, both groups showed improvements, but changes were significantly more pronounced in the study group. Oxygen saturation increased more in the study group, indicating enhanced respiratory function. Pulse rates decreased in both groups, with a greater drop in the study group, suggesting a stronger calming effect. Anxiety scores also fell more significantly in the study group, reflecting improved emotional regulation.* ***Conclusion:*** *These findings suggest that the LLLT at acupoint Baihui (GV 20) effective in in managing anxious children.*
***Keywords:*** *Low-level Laser Therapy, Local Anaesthesia, Child Dental Anxiety Scale*

## INTRODUCTION

Anxiety associated with dental procedures, particularly local anaesthesia administration, is a significant concern in pediatric dentistry. Children often experience heightened fear and apprehension when undergoing dental treatments, leading to behavioural management challenges for clinicians and distress for both patients and their caregivers. Traditional anxiety management strategies include behavioural conditioning techniques, pharmacological sedation, and psychological interventions. However, alternative and non-invasive therapeutic approaches, such as low-level laser therapy (LLLT), are gaining attention for their potential to alleviate anxiety and improve patient cooperation (Goel et al., 2017; Elbay et al., 2016). LLLT, a photo biomodulation technique, utilizes low-intensity laser wavelengths to stimulate cellular responses without inducing thermal damage. It has been widely studied for its applications in pain management, wound healing, and neurological conditions (Walker, 1983; Fontana &Bagnato, 2013). LLLT stimulates the body's cells by directly sending bio stimulation light energy to them (Perego R et al., 2016). The absorption of laser energy stimulates the molecules and atoms within cells. When low-intensity laser radiation is used on tissues, the temperature does not rise considerably or quickly. LLLT has been shown to advantageously manage pain, promote wound healing, and treat nerve injuries. The bio stimulatory action of laser irradiation causes physiological, metabolic, and functional changes in living microorganisms (Surendranath P et al., 2013). Photon absorption modifies the cell's molecular signal, causing a change in the photo acceptor molecular structure. The principal reactions involve changes to the photo acceptor function. Secondary reactions can affect cellular signalling and function (Arbabi-Kalati F et al., 2013). LLLT is an effective adjunctive treatment in a variety of dental specialties. It has a favourable effect on both the hard and soft tissues of the oral cavity, with fewer adverse effects.
Acupuncture is a traditional therapy that includes both a diagnostic and therapeutic approach. It was initially codified by the Yellow Emperor's Book of Medicine in China circa 2600 BC. The balance between the Yin and the Yang—the positive and negative energies of the universe—forms the basis for the understanding of illness in this regard, where acupuncture is an element of a comprehensive traditional

therapeutic approach. LASER acupuncture functions by absorbing and scattering light within tissues, triggering a bio-modulatory response. The photons from LASER therapy stimulate cellular activity, promoting physiological changes that aid in healing. Studies using magnetic resonance imaging (MRI) have demonstrated that LASER acupuncture activates specific brain regions responsible for releasing endorphins and enkephalins, further supporting its role in pain relief and recovery. Laser acupuncture is described as the stimulation of these conventional acupuncture points using a low-level laser. This procedure is not only painless but also non-invasive, atraumatic, simple to conduct, and free from the risk of cross-infection. Laser therapy on acupuncture points is useful for treating dental problems such as myofascial pain, gag reflex, and temporomandibular dysfunction (Sandhyarani et al., 2021). Acupuncture-based laser therapy targets specific points associated with stress reduction and neural modulation (Katti et al., 2014). Laser irradiation has a bio stimulatory effect that induces physiological, metabolic, and functional changes in living cells. In Traditional Chinese Medicine (TCM), Baihui (GV20) is a significant acupoint on the Du meridian (Governing Vessel), situated at the highest point of the head where all Yang meridians converge (Shen EY et al., 2011). Stimulation of this point through acupuncture is believed to enhance mental clarity, elevate mood, boost Yang energy, support the spleen's upward movement of Qi, dispel internal wind, and aid in restoring consciousness (Cheong YC et al., 2013). Due to these effects, GV20 is commonly utilized in the management of neurological and psychiatric conditions, including stroke, Alzheimer's disease, and insomnia (Wang WW et al., 2014).Thus, this clinical study aims to evaluate the effects of LLLT in managing anxiety among children aged 8-12 years before and after receiving local anaesthesia. The study will assess changes in anxiety levels, physiological responses, and patient cooperation to establish LLLT's viability as a non-invasive anxiety management technique in pediatric dentistry.

Thus, the aim of the study was to evaluate the effectiveness of Low-level LASER Therapy (LLLT) in managing anxious children of age 8-12 years before and after administration of Local Anaesthesia

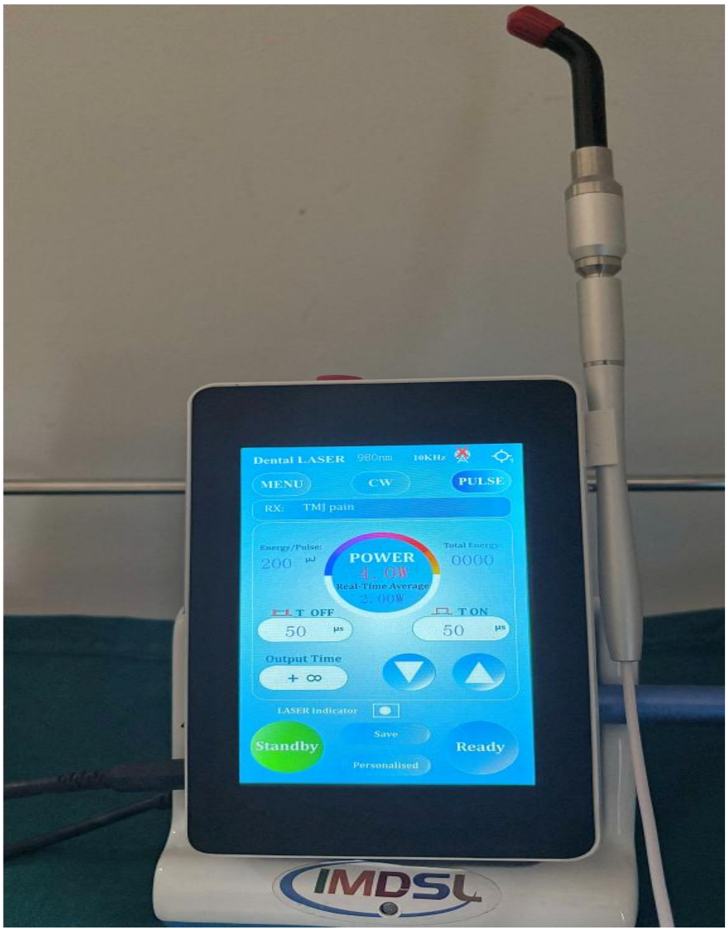

**Figure 1 Laser Device Used for LLLT**

**METHODOLOGY:**

Children aged 8–12 years reporting to the Department of Pediatric and Preventive Dentistry were considered for this study. The study protocol was approved by the Institutional Ethics Committee (Approval No. EC-23/56-PG-FDS). Written informed consent was obtained from parents or legal guardians, and verbal assent was obtained from each child. Inclusion criteria comprised children scheduled to receive local anaesthesia as part of dental treatment and exhibiting Frankl behaviour ratings of 1 or 2. Exclusion criteria included medically compromised children, those with special healthcare needs, children requiring emergency treatment, and cases in which parents or guardians declined to provide written informed consent.Patients requiring local anaesthesia as part of dental treatment were recruited and randomly assigned to one of two groups: Group 1 received Low-level Laser Therapy (LLLT) with (IMDSL LASER, Figure 1), in on-mode at the GV20 (Baihui) acupoint, and Group 2 received sham LLLT in off-mode at the same acupoint. At baseline, each patient's level of dental anxiety was assessed using the Faces version of the Modified Child Dental Anxiety Scale as a subjective measure, and physiological parameters, including pulse rate and oxygen saturation, were recorded using a pulse oximeter as objective measures. For the intervention, patients in Group 1 underwent low-level laser acupuncture in on-mode at GV20 for one minute at 200 mW, 980 nm, with an energy output of 3–4 J, while patients in Group 2 underwent the same procedure with the device in off-mode to ensure identical handling without therapeutic output. Local anaesthesia was then administered by a separate operator to maintain blinding. Immediately after local anaesthesia administration, anxiety levels were reassessed using the same subjective scale, and pulse rate and oxygen saturation were re-recorded.The patient, operator, and assistant were all given protective glasses during the laser acupuncture session. Pre- and post-intervention values within each group were analysed to determine changes in anxiety and physiological parameters, and comparative analysis between groups was conducted to evaluate the relative effectiveness of on-mode versus off-mode LLLT.

**Figure 2 Recording of pulse rate and oxygen saturation**


**Figure 3 Locating acupoint Baihui (GV20)**

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Figure 4 Performing LLLT at acupoint Baihui (GV20)

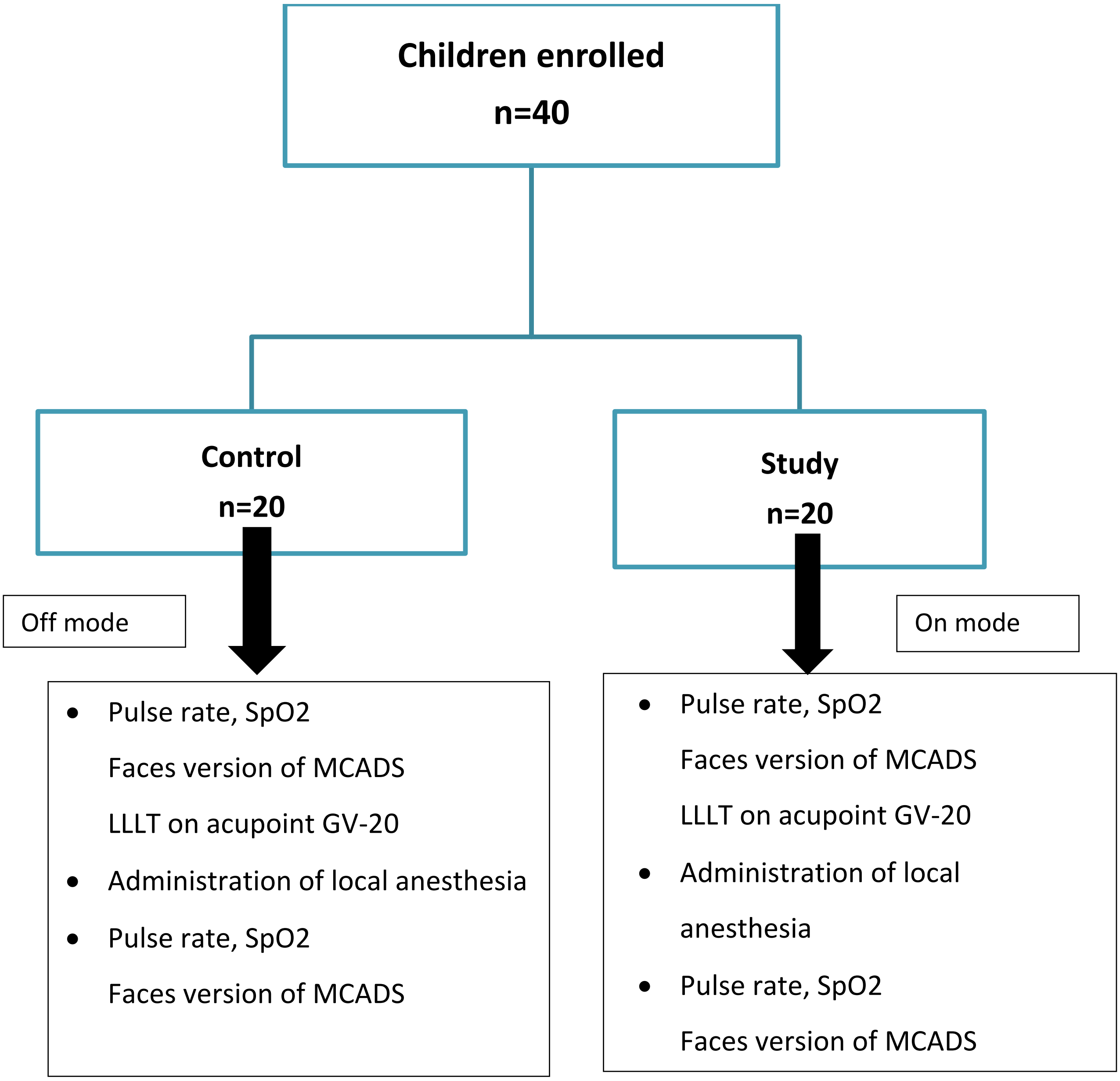


Figure 5 Consort flowchart

**Statistical analysis:**Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) for Windows, Version 22.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were presented as frequencies and proportions for categorical variables, and as means with standard deviations for continuous variables. Between-group comparisons of mean age, pulse rate (bpm), and $SpO_2$ levels (%) were conducted using the Independent Student's t-test, while within-group comparisons before and after intervention used the Paired Student's t-test. The Mann–Whitney test was applied to compare Modified Child Dental Anxiety Scale (Faces) [MCDAS(f)] scores between groups, and the Wilcoxon Signed-Rank test assessed within-group changes. Gender distribution between groups was compared using the Chi-square test. A p-value of <0.05 was considered statistically significant.

**RESULTS:**

**Age and Gender Distribution:**

The age distribution between the control and study groups showed slight differences, with the control group having a mean age of 8.70 ± 0.73 years and the study group having a mean age of 9.15 ± 1.14 years. The observed age ranges were slightly broader in the study group, spanning from 8 to 12 years, compared to the control group, which ranged from 8 to 10 years. However, the difference in age distribution between the two groups was not statistically significant (p=0.23) (Table 1, Figure 6).

**Table 1 Age and gender distribution among 2 groups**

| Variable | Category | Control | | Study | | p-value |
|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | |
| **Age** | Mean | 8.70 | 0.73 | 9.15 | 1.14 | 0.23[a] |
| | Range | 08 - 10 yrs. | | 08 - 12 yrs. | | |
| | | n | % | n | % | |
| **Sex** | Males | 7 | 35.0% | 9 | 45.0% | 0.52[b] |
| | Females | 13 | 65.0% | 11 | 55.0% | |

a. Independent Student t Test & b. Chi Square Test

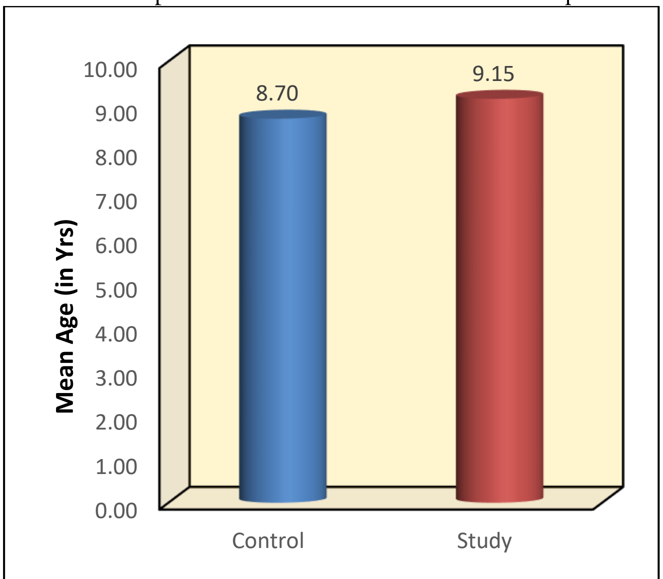


**Figure 6 Age wise distribution between 2 groups**

Regarding gender distribution, the control group comprised 35.0% (n=7) males and 65.0% (n=13) females, whereas the study group had 45.0% (n=9) males and 55.0% (n=11) females. The difference in gender distribution between the groups was not statistically significant (p=0.52) (Figure 7).

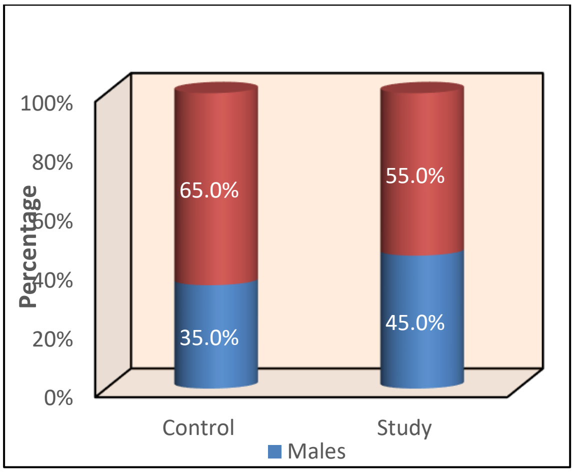


**Figure 7 Gender wise distribution between 2 groups**

**Modified Child Dental Anxiety Scale:** Before the intervention period, the mean MCDAS (f) anxiety score in the control group was 12.60 ± 2.23, while in the study group, it was slightly higher at 12.65 ± 2.08. The difference in mean anxiety scores between the groups was minimal at -0.05, with a p-value of 0.89, indicating that the difference was not statistically significant (Table 2, Figure 8).

**Table 2 Comparison of mean MCDAS (f) Scores before intervention period between 2 groups using Mann Whitney Test**

| Parameter | Group | N | Mean | SD | Mean Diff | p-value |
|---|---|---|---|---|---|---|
| Anxiety Scores | Control | 20 | 12.60 | 2.23 | -0.05 | 0.89 |
| | Study | 20 | 12.65 | 2.08 | | |

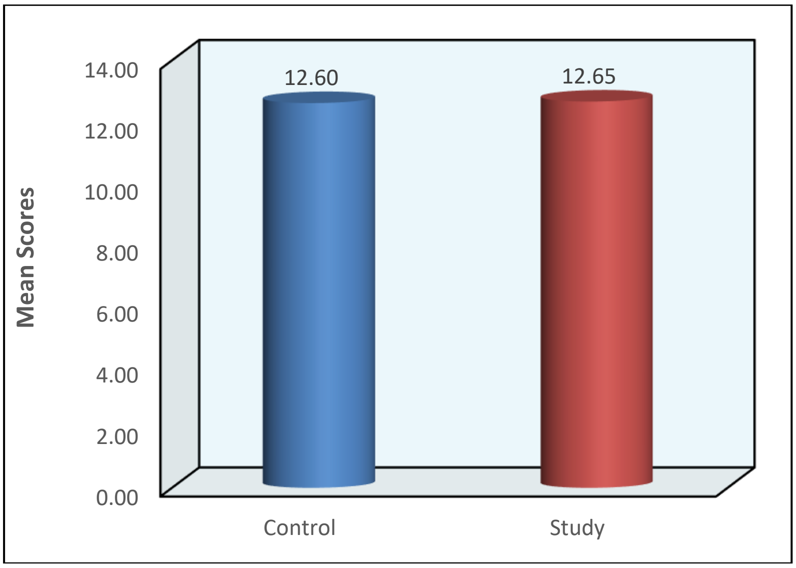


**Figure 8 Mean MCDAS (f) Scores before intervention period between 2 groups**

After the intervention period, the mean MCDAS (f) anxiety score in the control group was 10.90 ± 2.45, whereas in the study group, it was lower at 9.45 ± 1.10. The mean difference in anxiety scores between the groups was 1.45, with a p-value of 0.02, indicating a statistically significant reduction in anxiety levels in the study group compared to the control group (Table 3, Figure 9).

**Table 3 Comparison of mean MCDAS (f) Scores after intervention period between 2 groups using Mann Whitney Test**

| Parameter | Group | N | Mean | SD | Mean Diff | p-value |
|---|---|---|---|---|---|---|
| Anxiety Scores | Control | 20 | 10.90 | 2.45 | 1.45 | 0.02* |
| | Study | 20 | 9.45 | 1.10 | | |

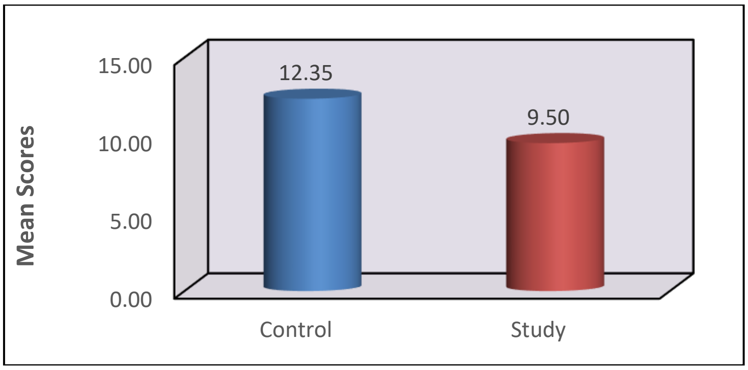


**Figure 9 Mean MCDAS (f) Scores after intervention period between 2 groups**

In the control group, the mean MCDAS (f) anxiety score before the intervention period was 12.60 ± 2.23, which decreased to 10.90 ± 2.45 after the intervention. The mean difference in anxiety scores was 1.70, with a p-value of <0.001, indicating a statistically significant reduction in anxiety levels following the intervention.

Similarly, in the study group, the mean anxiety score before the intervention was 12.65 ± 2.08, which declined further to 9.45 ± 1.10 after the intervention. The mean difference in anxiety scores was 3.20, with a p-value of <0.001, signifying a statistically significant improvement in anxiety levels post-intervention (Figure 10).

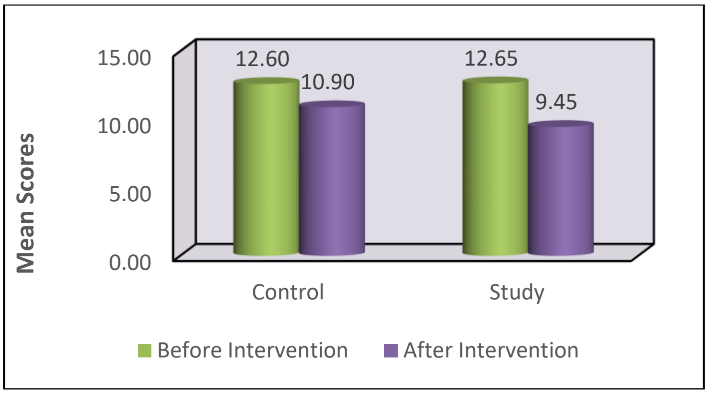


**Figure 10 Mean MCDAS (f) Scores b/w before & after intervention period in each group**

**Oxygen saturation:**

Before the intervention period, the mean SpO2 level in the control group was 95.85 ± 4.25%, while in the study group, it was slightly higher at 96.75 ± 2.86%. The difference in mean SpO2 levels between the groups was -0.90%, with a p-value of 0.44, indicating that the difference was not statistically significant (Table 4, Figure 11).

**Table 4 Comparison of mean SpO2 levels (in %) & Pulse Rate (bpm) before intervention period between 2 groups using Independent Student t Test**

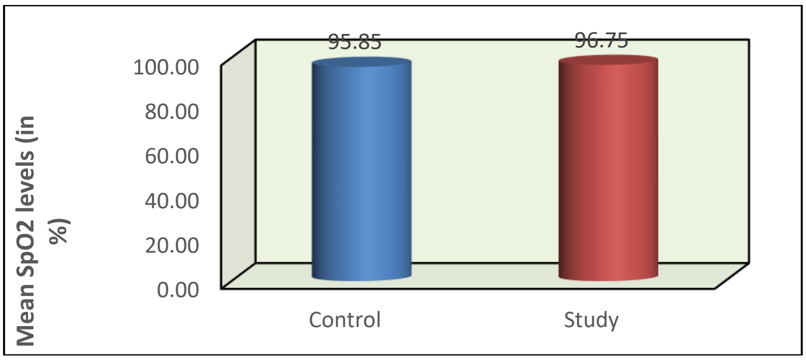


**Figure 11 Mean SpO2 levels (in %) before intervention period between 2 groups**

**Table5 Comparison of mean SpO2 levels (in %) & Pulse Rate (bpm) after intervention period between 2 groups using Independent Student t Test**

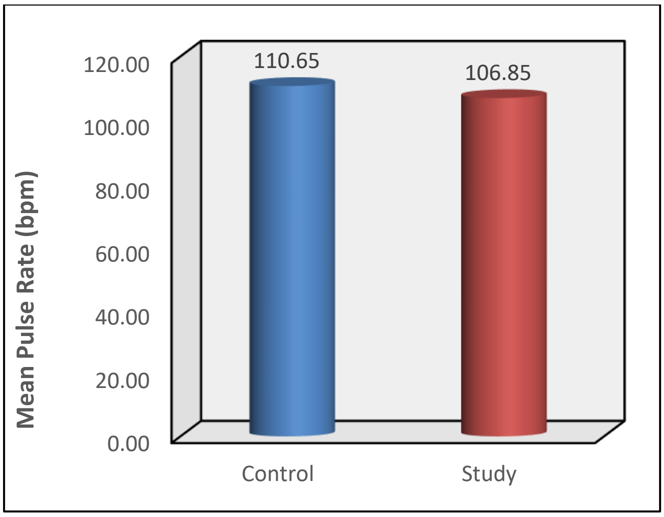


**Figure 12 Mean Pulse Rate (bpm) before intervention period between 2 groups**

Regarding pulse rate, the control group had a mean pulse rate of 110.65 ± 11.24 bpm, whereas the study group had a slightly lower mean pulse rate of 106.85 ± 9.91 bpm. The mean difference in pulse rate between the groups was 3.80 bpm, with a p-value of 0.26, suggesting that the difference was also not

| Parameter | Group | N | Mean | SD | Mean Diff | p-value |
|---|---|---|---|---|---|---|
| SpO2 levels | Control | 20 | 95.85 | 4.25 | -0.90 | 0.44 |
| | Study | 20 | 96.75 | 2.86 | | |
| Pulse Rate | Control | 20 | 110.65 | 11.24 | 3.80 | 0.26 |
| | Study | 20 | 106.85 | 9.91 | | |

statistically significant (Figure 12 ).

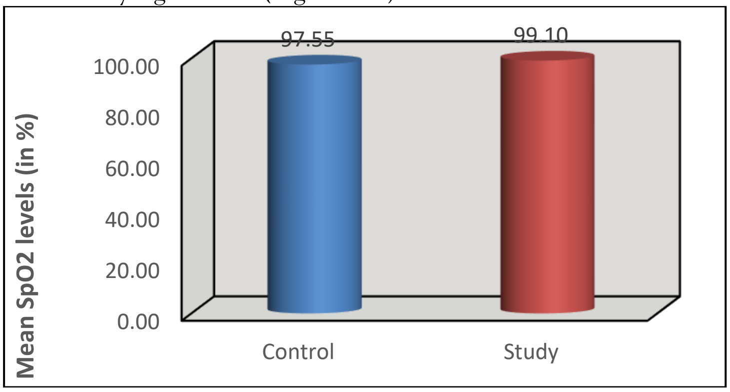


**Figure 13 Mean SpO2 levels (in %) after intervention period between 2 groups**

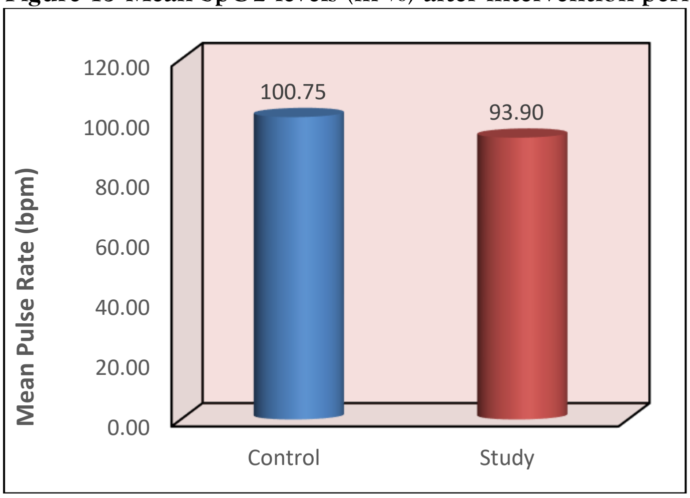


**Figure 14 Mean Pulse Rate (bpm) after intervention period between 2 groups**

After the intervention period, the mean SpO2 level in the control group was 97.55 ± 1.54%, whereas in the study group, it was significantly higher at 99.10 ± 1.02%. The difference in mean SpO2 levels between the groups was -1.55%, with a p-value of 0.001, indicating a statistically significant difference (Table 5, Figure 12).Regarding pulse rate, the control group had a mean pulse rate of 100.75 ± 9.99 bpm, while the study group exhibited a lower mean pulse rate of 93.90 ± 4.62 bpm. The mean difference in pulse rate between the groups was 6.85 bpm, with a p-value of 0.008, suggesting that the reduction in pulse rate observed in the study group was statistically significant (Figure 5.9)In the control group, the mean SpO2 level before the intervention period was 95.85 ± 4.25%, which increased to 97.55 ± 1.54% after the intervention. The mean difference in SpO2 levels was -1.70%, with a p-value of 0.03, indicating a statistically significant improvement following the intervention.Similarly, in the study group, the mean SpO2 level before the intervention period was 96.75 ± 2.86%, which rose to 99.10 ± 1.02% after the intervention. The mean difference in SpO2 levels was -2.35%, with a p-value of <0.001, signifying a statistically significant enhancement in oxygen saturation post-intervention (Table 6, Figure 15).

**Table 6 Comparison of mean SpO2 levels (in %) b/w before & after intervention period in each group using Student Paired t Test**

| Parameter | Time | N | Mean | SD | Mean Diff | p-value |
|---|---|---|---|---|---|---|
| Control | Before Intervention | 20 | 95.85 | 4.25 | -1.70 | 0.03* |
| | After Intervention | 20 | 97.55 | 1.54 | | |
| Study | Before Intervention | 20 | 96.75 | 2.86 | -2.35 | <0.001* |
| | After Intervention | 20 | 99.10 | 1.02 | | |

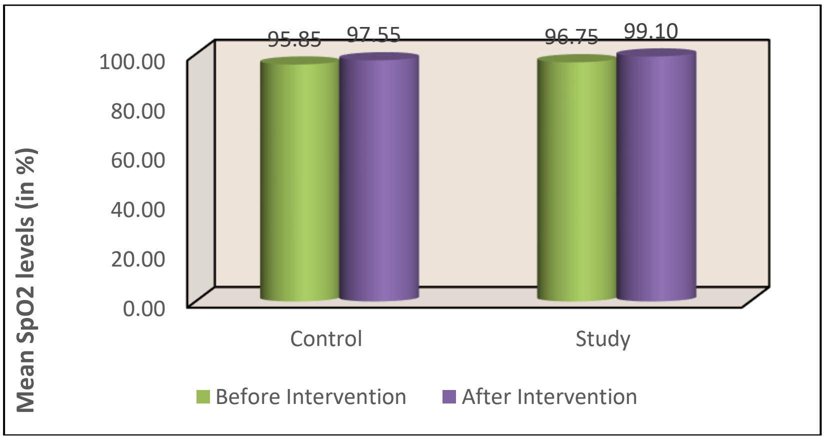

**Figure 15 Mean SpO2 levels (in %) b/w before & after intervention period in each group**

In the control group, the mean pulse rate before the intervention period was 110.65 ± 11.24 bpm, which decreased to 100.75 ± 9.99 bpm after the intervention. The mean difference in pulse rate was 9.90 bpm, with a p-value of <0.001, indicating a statistically significant reduction following the intervention.
Similarly, in the study group, the mean pulse rate before the intervention period was 106.85 ± 9.91 bpm, which declined further to 93.90 ± 4.62 bpm after the intervention. The mean difference in pulse rate was 12.95 bpm, with a p-value of <0.001, signifying a statistically significant reduction in pulse rate post-intervention (Table 7, Figure 16).

**Table 7 Comparison of mean Pulse Rate (bpm) b/w before & after intervention period in each group using Student Paired t Test**

| Parameter | Time | N | Mean | SD | Mean Diff | p-value |
|---|---|---|---|---|---|---|
| Control | Before Intervention | 20 | 110.65 | 11.24 | 9.90 | <0.001* |
| | After Intervention | 20 | 100.75 | 9.99 | | |
| Study | Before Intervention | 20 | 106.85 | 9.91 | 12.95 | <0.001* |
| | After Intervention | 20 | 93.90 | 4.62 | | |

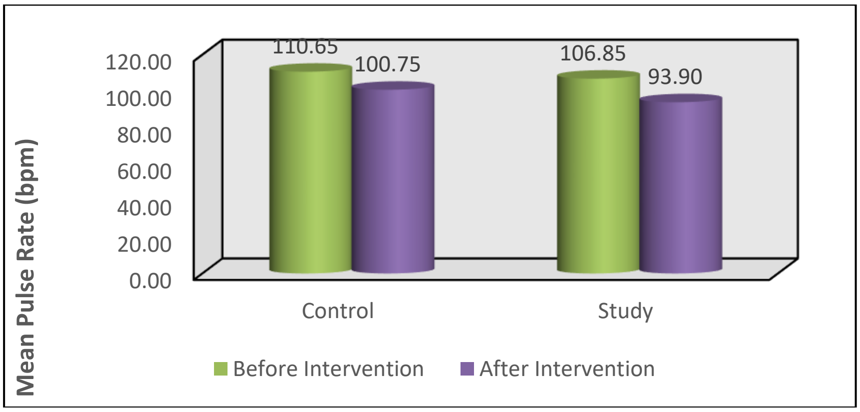


**Figure 16 Mean Pulse Rate (bpm) b/w before & after intervention period in each group**

## DISCUSSION

The present clinical trial evaluated the effect of Low-Level Laser Therapy (LLLT) on managing anxiety in children aged 8–12 years before and after the administration of local anaesthesia. Anxiety during dental procedures, particularly in pediatric patients, is a common challenge that can impact treatment outcomes and patient cooperation (Klingberg and Broberg, 2007). This study aimed to assess whether LLLT could serve as an effective non-pharmacological approach to reducing anxiety levels and improving physiological responses. The study systematically analysed the effects of LLLT on acupoint GV 20 on oxygen saturation, pulse rate, and anxiety levels, comparing control and study groups over different time points. The results provided insights into LLLT's physiological and psychological impact, revealing distinct patterns in both groups. Before the intervention, oxygen saturation levels were largely similar, with the study group showing slightly higher values. Following the intervention, both groups experienced an increase in oxygen saturation, though the study group exhibited a more pronounced improvement, suggesting a stronger physiological response. Pulse rate measurements initially showed minor differences between the groups. After the intervention, both groups demonstrated a decline in pulse rate, indicating stabilization. However, the study group showed a more significant reduction, pointing to enhanced cardiovascular regulation and a stronger calming effect. Anxiety scores were comparable between the groups before the intervention, with only slight variations. Post-intervention, both groups experienced reduced anxiety, but the decline was more notable in the study group, indicating greater psychological relief and improved emotional regulation. Overall, the intervention led to positive changes in oxygen saturation, pulse rate, and anxiety levels in both groups, with the study group consistently showing more substantial benefits. These findings suggest that the intervention had a significant impact on improving physiological and psychological well-being, particularly in the study group.
According to the American Academy of Paediatric Dentistry (AAPD), children's cognitive and emotional development, as well as pain responses, might differ(McDonald RE, Avery DR et al). When it comes to paediatric dentistry, managing pain and gaining the child's cooperation have always been difficult( Nair M, Gurunathan D et al ).
Baihui (GV 20) is an important acupoint on the Governor Vessel, located at the highest point of the head (Figure 5.12), where all yang meridians converge (Ju et al., 2009; Chuang et al., 2007). It is widely recognized for its therapeutic effects in alleviating headaches, strokes, dizziness, and anxiety (Satoh et al., 2009). As a crucial component of the meridian acupoint system, Baihui (GV 20) is responsible for enhancing nitric oxide (NO) production and increasing local circulation, making it beneficial for various physiological functions (Tsuchiya et al., 2007; WHO, 1999). Beyond its peripheral effects, Baihui (GV 20) is believed to exert a stimulatory influence on the central nervous system rather than solely acting on peripheral nerves. This stimulation may trigger the release of neurotransmitters or neuromodulators within the brain and spinal cord, facilitating pain modulation and the secretion of hormones involved in self-regulatory mechanisms (WHO, 1999; Tsuchiya et al., 2007). These biochemical changes are thought to activate the body's natural healing processes, fostering both physical and emotional well-being. Three primary mechanisms contribute to these effects: the conduction of electromagnetic signals, activation of opioid pathways, and modulation of brain chemistry, sensory perception, and autonomic functions (WHO, 1999). Through these processes, Baihui (GV 20) has been utilized in traditional medicine to regulate bodily functions and improve overall health outcomes.

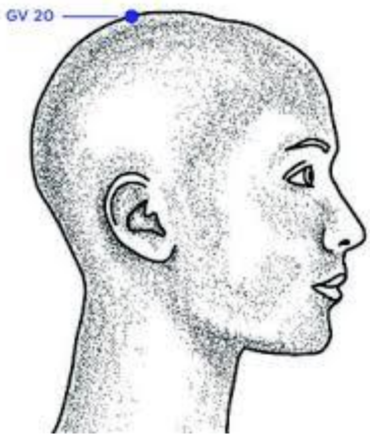


**Figure 5.12 Acupoint Baihui (GV 20)**

Acupuncture at the GV 20 (Baihui) point has been studied for its potential to alleviate anxiety through various physiological and neurological mechanisms: Stimulation of GV 20 has been linked to multiple mechanisms influencing mood and anxiety regulation. Neurochemically, electroacupuncture at GV 20 has been shown to increase serotonin levels, promoting mood stabilization, and in combination with SP 6, elevate norepinephrine and dopamine in the hippocampus, enhancing stress resilience (Zhao et al., 2007). Neurologically, it can alter brain activity patterns, with EEG studies showing increased alpha and decreased beta waves, indicative of relaxation. Functional MRI research suggests it modulates amygdala connectivity, potentially improving emotional regulation (Duan et al., 2020). Acupuncture may also lower cortisol levels through hypothalamic-pituitary-adrenal axis modulation, reducing stress. From a Traditional Chinese Medicine perspective, GV 20 is regarded as a key point for calming the spirit, regulating Qi, and promoting mental clarity and emotional balance. Acupuncture at GV 20 may alleviate anxiety through a combination of neurotransmitter modulation, alteration of brain activity patterns, functional connectivity changes in emotion-related brain regions, and potential regulation of stress hormones. These findings are supported by both modern scientific research and traditional medical theories (Zhao, N.X et al., 2007). A study by Lee et al. (2017) investigated the impact of laser acupuncture at GV20 on brain damage and oxidative stress in a rat model of cerebral ischemic stroke. The findings suggested that laser stimulation at GV20 could ameliorate cerebral damage, indicating potential neuroprotective effects (Jittiwat, J et al., 2017). Another study examined the effects of manual acupuncture at GV20 on depression induced by water-immersion stress in rats. The results demonstrated that stimulation at GV20 significantly alleviated depressive behaviours, suggesting its role in modulating mood-related disorders. Furthermore, research has indicated that acupuncture at GV20 can influence autonomic nervous system activity. A study reported that stimulation at this point modulated vascular, endocrine, immune, and nervous systems, which are often implicated in anxiety disorders. While direct studies on LLLT at GV20 for anxiety reduction are limited, the existing research on acupuncture at this point provides a foundation for its potential benefits. The non-invasive nature of LLLT makes it a promising modality for stimulating GV20, especially in populations sensitive to needle-based acupuncture, such as children (Deng D et al., 2016).

Pre-intervention $SpO_2$ levels were comparable between the control (95.85% ± 4.25) and study groups (96.75% ± 2.86), with no significant difference (p=0.44).Post-intervention, the study group exhibited a significantly higher mean $SpO_2$ level (99.10% ± 1.02) compared to the control group (97.55% ± 1.54), with a p-value of 0.001.Within-group analysis also confirmed significant increases in $SpO_2$ for both groups (Study: p<0.001; Control: p=0.03), with a more pronounced improvement in the study group (2.35% vs. 1.70%). These findings align with previous research indicating that audio-visual distraction techniques can positively influence physiological parameters during dental procedures. For instance, a systematic review and meta-analysis by Zhang et al. (2019) found that audio-visual distraction significantly reduced heart rate in children during dental treatments, suggesting a calming effect that could also enhance oxygen saturation levels. This improvement aligns with existing evidence on the physiological benefits of low-level laser therapy (LLLT), including enhanced tissue oxygenation. Research by Ghajari et al. (2024) demonstrated that photo biomodulation accelerates recovery in pediatric dental procedures by improving microcirculation and oxygen delivery at the cellular level (Ghajari et al., 2024). Similarly, Bardellini et al. (2020) found that LLLT improved healing and comfort in children with oral mucosal lesions, likely through enhanced oxygen utilization (Bardellini et al., 2020). Baseline pulse rates showed no significant differences between the control (110.65 ± 11.24 bpm) and study groups (106.85 ± 9.91 bpm, p=0.26).Post-intervention, the study group demonstrated a significantly lower mean pulse rate (93.90 ± 4.62 bpm) compared to the control group (100.75 ± 9.99 bpm), with a p-value of 0.008.Both groups experienced significant reductions in pulse rate (Study: p<0.001; Control: p<0.001), with a greater decrease observed in the study group (12.95 bpm vs. 9.90 bpm).This substantial reduction in pulse rate is consistent with findings from Al-Khotani et al. (2016), who reported that audio-visual distraction significantly decreased heart rate in children undergoing dental procedures, indicating reduced anxiety and improved physiological stability .This result supports findings by Dogan et al. (2021), who reported a decrease in pulse rate following LLLT at acupressure points, indicating autonomic nervous system modulation during dental procedures (Dogan et al., 2021). Additionally, Goel et al. (2017) observed reduced cardiovascular response, including pulse rate, when LLLT was applied to the P6 acupoint in children with exaggerated gag reflexes, reinforcing the calming effects of laser acupuncture (Goel et al., 2017).

Pre-intervention anxiety scores were similar between the control (12.60 ± 2.23) and study groups (12.65 ± 2.08), with no significant difference (p=0.89). Post-intervention, the study group exhibited significantly lower anxiety scores (9.45 ± 1.10) compared to the control group (10.90 ± 2.45), with a p-value of 0.02. Within-group analyses showed significant reductions in anxiety for both groups (Study: p<0.001; Control: p<0.001), with a more substantial decrease in the study group (3.20 vs. 1.70). These results are in line with a systematic review by Barreiros et al. (2018), which concluded that audiovisual distraction methods effectively reduce dental anxiety in children. Additionally, Jamil et al. (2023) found that combining audiovisual distraction with filmed modeling significantly decreased anxiety and fear in pediatric dental patients. This finding is consistent with prior studies showing LLLT's anxiolytic effect. Basili et al. (2017) and Ferreira et al. (2013) demonstrated that laser acupuncture significantly reduced symptoms in patients with temporomandibular disorders and myofascial pain, suggesting its systemic anxiolytic and analgesic effects (Basili et al., 2017; Ferreira et al., 2013). Moreover, Sandhyarani et al. (2021) showed that stimulating the LI4 acupoint with LLLT during dental anaesthesia in children significantly reduced discomfort and pain (Sandhyarani et al., 2021).

Acupuncture has been utilized in dentistry as a pain management technique. In a study conducted by Usichenko et al., bilateral acupuncture at LI4 was applied using indwelling fixed needles to evaluate its effectiveness. The findings revealed that patients who received LI4 stimulation maintained a lower heart rate throughout the dental procedure compared to those undergoing treatment without acupuncture, demonstrating its efficacy in regulating physiological responses and reducing stress during dental interventions.

Usichenko et al. conducted additional studies to evaluate the effectiveness of LI4 point stimulation, utilizing "New Pyonex" needles for activation. Their findings confirmed that LI4 stimulation was both safe and effective, significantly reducing pain experienced during treatment in both children and parents (Usichenko TI et al., 2016).The key benefit of using low-level laser therapy over manual needling is its efficiency, requiring significantly fewer clinical appointments. Laser therapy typically takes between 20 seconds to 15 minutes for stimulation, whereas traditional needle acupuncture requires approximately 15–30 minutes per session(de Oliveira RF et al., 2015).The results of this study support the effectiveness of Low-level Laser Therapy on acupoint GV 20 in Managing Anxious Children and showed improvement in physiological ($SpO_2$, pulse rate) and psychological (anxiety) parameters in pediatric dental patient. Future research should focus on conducting high-quality randomized controlled trials with larger sample sizes to evaluate the efficacy of low-level laser therapy (LLLT) in pediatric dentistry. Studies should explore its clinical applications for pain and anxiety management, assessing different wavelengths, wavelength combinations, and energy densities across various age groups. Additionally, efforts should be directed toward developing standardized, evidence-based, pediatric-specific protocols to guide LLLT application.

## CONCLUSION

The Low-level laser acupuncture at GV20 significantly improved physiological and psychological outcomes in the study group compared to the control group. Specifically, it led to higher oxygen saturation levels, greater reductions in pulse rates, and a marked decrease in anxiety levels. The results of the present study demonstrate that Low-level Laser acupuncture Therapy at GV20 acupoint was effective in managing anxious children of age 8-12 Years during administration of local anaesthesia.

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