# Feasibility of Using Somatosensory Input on Children Receiving Dental Treatment

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## Abstract

- **Objective**: The aim of this randomized, cross-over designed feasibility study was to determine whether somatosensory input leads to decreased anxiety for pediatric dental patients, and improved experiences overall.
- **Methods**: Children aged 5 - 15 years, needing at least two appointments for restorative treatment requiring local anesthesia under basic behavior guidance techniques were recruited. Patients were randomly allocated to wearing a vibrating weighted vest at one of the appointments. At both appointments, patients wore a watch which measured heart rate, electrodermal activity, and skin conductance. Patients' response was obtained at the beginning and at the end of each appointment using a facial image scale. Parents were requested to complete a sensory profile questionnaire regarding their child's sensory integration.
- **Results**: A total of 32 patients were enrolled, and 10 patients completed the study with the average age being 9.6 years. When comparing the Frankl scores for visits with the vest and those without, the scores were not significantly different (p-value=0.5724). The first FIS score was the same for all patients with and without the vest, and the second FIS score was the same under both conditions for 67% of the patients.
- **Conclusion**: Based on the results from the study, there is not strong evidence for the weighted vest leading to better outcomes. This indicates that other factors such as use of basic behavior guidance techniques and coping skills may play more of a vital role in decreasing patient anxiety during dental appointments.

## Introduction

- Dental fear and anxiety (DFA) is common across many populations, ages, and backgrounds. The prevalence of dental anxiety in children ranges from 5% to 61%, and in adults from 1% to 52%[1,2]. It is known that individuals with anxiety tend to have higher comorbidities; thus this population tends to have increased use of healthcare and healthcare visits[3]. Particularly in the dental setting, we observe that the cost of care can be higher as patients seek more emergent care due to neglectful and avoidance behaviors associated with anxiety[4]. Ultimately when DFA is encountered in the dental setting, it can result in behavior management problems[2]. Literature has even demonstrated a number of risk factors associated with behavior management problems, among them being tooth pain, young age, parental expectations, anxiety or shyness around strangers, and even negative guardian expectations of child's behavior during that appointment[5]. [8]Children with dental anxiety can be difficult to manage during treatment, and that anxiety can persist into adulthood and lead to avoidance[6]. Dental neglect as a result of fear can lead to caries, dental infection, and even tooth loss[7].
- Furthermore, it is particularly common to see dental fear and anxiety amongst children with developmental disabilities and somatosensory input disorders. Children with developmental disabilities tend to have higher levels of anxiety as well as behavioral problems than typically developing children[8]. Patients who have a difficult time integrating various types of stimuli may find tolerating treatment in the dental setting particularly difficult. Medical settings, such as dental offices, often have stimuli such as air, water, pressure, high and low pitched sounds, vibration, and at times pain.
- Use of non-pharmacological behavior management methods, such as sensory adapted dental environment, deep touch pressure, and vibration may contribute to a more positive dental experience by alleviating anxiety. Studies have shown improved physiological and behavioral responses to individual types of somatosensory inputs, such as the use of a weighted blanket, or vibration. However, there are no studies that show the effects of these combined sensory adaptations for the pediatric patient during dental treatment. The purpose of this study is to evaluate the combination of the somatosensory inputs with one device to reduce anxiety in the pediatric population, and assess the effectiveness.

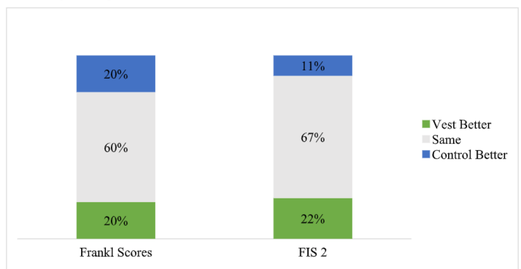
## Methods

- The targeted population included 50 patients between the ages of 5 to 15 years old. Participants were recruited by the dental resident/provider based on eligibility and the need for dental treatment. This study was conducted as a randomized cross-over study design, for which the participants received the weighted vest for only one of the visits. The Sensory Profile 2, an 86-question survey, was administered to parent/guardian to complete about the child's sensory integration. The facial image scale (FIS) is an alternative picture scale where children are requested to choose one face from a row of five that best corresponds to how they are feeling (very unhappy to happy). These faces correspond with a number, 1 being the most happy and 5 being the most unhappy. This was repeated again when the vest was removed at the end of the appointment, and again at the next appointment prior to beginning treatment and at the ending.
- The research data input sheet is where all notes were made for stimuli that were introduced throughout the appointment, including information about what type of procedure is done, and the details surrounding the treatment such as type of isolation used, the time of appointment, who the provider is, and any significant details about the appointment that may have impacted treatment or the study. During the intervention appointment, patients were informed that they may stop the vibration of the vest, or discontinue wearing the vest at any time, but would still receive dental treatment.
- The magnitude of the vibration motors on the weighted vest was constant. The rated speed range for the NFP-E0716 encapsulated vibration motors used is 12,000 +/- 2,500 rpm, with a rated voltage of 3V DC and rated current of ≤250mA. All data information, including scores, timings, and other pertinent information were transferred from the data input sheet and then stored on an active spreadsheet with the deidentified patient data including the patient ID. This research was supported by the Alexander Fellowship, and the research design was approved by the Institutional Review Board of Virginia Commonwealth University (#20026215).

## Results

- Patient outcomes (Frankl and FIS scores) with and without the use of the vest were compared within subjects using McNemar's chi-squared tests. Descriptive statistics (counts, percentages) were used to describe the rates of improvements when the patient utilized the vest. Higher Frankl scores were considered optimal whereas lower FIS scores were considered better. Significance level was set at 0.05. SAS EG v.8.2 (SAS Institute, Cary, NC) was used for all analyses.
- A total of 32 patients were enrolled in the study, and 10 participants completed the study to date. Three of the ten patients completed their first visit with the study vest and the remaining seven began with the standard control setting (no vest). Each patient received the remaining treatment for their second visit. The average age of participants was 9.6 (SD=2.9) and ranged from 5 to 15. See summary in Table 1.
- When comparing the Frankl scores for visits with the vest and those without, the scores were not significantly different (p-value=0.5724). Sixty percent of patients demonstrated the same Frankl score at both visits. An equal number of the remaining patients had higher Frankl scores with the vest (n=2, 20%) and without (n=2, 20%). Complete results provided in Table 2 and Figure 1.

**Figure 1: Summary of Improvement Rates for Patient Outcomes With and Without Use of Vest**




*Note: Higher Frankl scores and lower FIS scores were considered better

**Table 1: Summary of Patients**

| | Mean | SD |
|---|---|---|
| Age | 9.6 | 2.9 |
| | n | % |
| Treatment Order | | |
| Vest First | 3 | 30% |
| Vest Second | 7 | 70% |

- Both patients who had higher Frankl scores with the vest received the vest on their second visit. For the two patients who demonstrated better scores without the vest, they were evenly split with one starting with the vest and one without. The first FIS score was the same for all patients with and without the vest (Table 2).

**Table 2: Comparison of Patient Outcomes With and Without Use of Vest**

| | Vest | Control | P-value |
|---|---|---|---|
| **Frankl Score** | | | 0.5724 |
| 1 | 0, 0% | 0, 0% | |
| 2 | 1, 10% | 1, 10% | |
| 3 | 1, 10% | 2, 20% | |
| 4 | 8, 80% | 7, 70% | |
| **FIS 1** | | | >0.999 |
| 1 | 1, 10% | 1, 10% | |
| 2 | 7, 70% | 7, 70% | |
| 3 | 2, 20% | 2, 20% | |
| 4 | 0, 0% | 0, 0% | |
| **FIS 2** | | | 0.9536 |
| 1 | 3, 30% | 3, 30% | |
| 2 | 3, 30% | 2, 20% | |
| 3 | 3, 30% | 4, 40% | |
| 4 | 0, 0% | 0, 0% | |

*P-value from McNemar's chi-squared test

- The second FIS score was the same under both conditions for 67% of the patients. Of the remaining three patients, two had a better score with the vest (22%) and one had a better score without (11%) (Table 2, Figure 1). The two patients who had better FIS scores with the vest initially received the control setting as their first visit. The patient who performed worse with the vest received the vest for the first visit. Therefore, all three patients who demonstrated different FIS scores with and without the vest had better scores on their second visit.

## Conclusions

- Based on the results from this study, it can be concluded that there is not strong evidence for the weighted vest leading to better outcomes. This indicates that children may have other coping mechanisms, alongside the use of what is provided at each appointment such as basic behavior guidance techniques. Future studies that investigate somatosensory input should be completed and conducted in a setting such as pediatric dentistry. Increasing the ways care is provided while employing basic behavioral guidance techniques would expand what is able to be accomplished for a large patient population.

## References/ Acknowledgements

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