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Comparative Study of Pain Perception with Use of Vibration and/or Cold Stimulation Applied During Local Anesthetic Delivery in a Dental Setting: A Systematic Review

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ABSTRACT/BACKGROUND

Delivery of local anesthetic can be one of the most difficult parts of the procedure for pediatric patients undergoing dental treatment and can prevent the child from being able to cooperate for treatment as well as instill anxiety for future visits.¹ Several methods can be utilized to help mitigate pain control during the local anesthetic injection including behavior management, vibration, cold sensation, warming the anesthetic, and topical anesthetic.⁴ These methods are essential to helping the child have a good experience and ultimately be able to tolerate treatment for caries management and a long term positive view of the dentist.

One technique that has been previously researched is the use of vibration and cold stimulation when delivering local anesthetic. Vibration and cold stimulation can block the afferent pain fibers (A delta and C fibers), an idea based on the gate control theory, thus reducing pain.¹¹ These two methods, cold stimulation and vibration, can be especially advantageous for a pediatric population because they are both non-invasive.

This systematic review is aimed at reviewing randomized control studies to evaluate the efficacy of using vibration and/or cold stimulation devices while administering local anesthetic in order to lower pain perception and dental anxiety. Several modern devices have been invented to introduce vibration and/or cold stimulation that can be utilized during dental treatment however, research on these devices is limited. Additionally, a systematic review is needed to guide further research as well as a proposed design study to further evaluate the efficacy of using vibration and/or cold stimulation during local anesthetic delivery.

METHODS

Eligibility criteria. Inclusion criteria for studies included in this review were randomized control trials following the PICO strategy as described below:

- P (participants): Healthy and cooperative children with no systemic diseases or allergies requiring local anesthesia for dental treatment
- I (intervention): use of vibration and/or cold stimulation device during local anesthetic injection
- C (comparison): conventional delivery of local anesthetic
- O (outcome): determination of lower pain perception and dental anxiety



<https://www.amazon.in/Buzzy-Relief-System-Takes-Sting/dp/B004UMOWBM>

Serial number	Author/year	City, country	Groups	Age range	Sample	Method used	Outcome of interest	Results
1.	Suohu et al. 2020 ¹	Sitapura, Jaipur	Group I: 25 subjects conventional syringe Group II: 25 subjects Buzzy Bee™ vibrational device used	5-10 years old requiring local anesthetic	50 Children	Comparative Evaluation	Pulse ox results were non significant, WBFPRS non significant, FLACC score significant	"External cold and vibration via Buzzy™ can reduce pain and anxiety during local anesthetic delivery for various dental procedure"

SYNTHESIS OF RESULTS

Ten studies¹⁻¹⁰ were included in this systematic review. Five^{1,2,3,6,8} of the ten studies compared pain and anxiety reduction of conventional LA delivery to the use of the Buzzy Bee™ system which also utilizes "icepack" wings for cold stimulation. One study⁴ utilized a prototype, vibration toy in the shape of a fish versus the conventional study whereas, two studies^{7,9} similarly compared the conventional method versus the use of DentVibe™. Finally, two studies^{5,10} compared the conventional method, a computerized delivery system and Dentvibe™. Of those ten studies seven^{1,2,3,4,6,8,9} reported that the vibrational distraction method did decrease the perception of pain and anxiety amongst young patients during local anesthetic delivery prior to dental work. Two studies^{7,10} reported that patients experienced no difference in perception of pain nor anxiety between the different methods of local anesthetic delivery. One study¹⁰ reported that the conventional method was superior to both the vibrational and computerized methods.

DISCUSSION

Oftentimes the largest hurdle in pediatric dentistry is delivering local anesthetic prior to dental treatment. There are many methods and behavior management techniques to help overcome this challenge. The objective of this systematic review is to determine if the use of vibrational anesthesia and/or cold stimulation reduces the pain and anxiety experienced by the child during local anesthetic delivery. Seven out of the ten articles in this study reported a decrease in pain perception and/or dental anxiety with the use of vibrational anesthesia and/or cold stimulation during the administration of local anesthetic in a dental setting. A limitation of this analysis is the lack of consistency, standardized testing and evaluation of effectiveness of modern vibrational devices amongst the randomized control trials. It is recommended that additional research be performed with the implementation of a standardized test and evaluation.

CONCLUSION

Based on the results of this systematic review, the following conclusions can be made:

1. There is evidence to support the use of devices that vibrate aid in lowering pain perception and dental anxiety in pediatric patients who require local anesthesia in a dental setting
2. There is also evidence that supports that the local anesthetic delivery method does not affect the pain and anxiety perceived by a pediatric dental patient
3. Additional evaluation of modern vibration and/or cold stimulation devices on the efficacy of lowering pain perception and dental anxiety through randomized control trials is needed

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