



# 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

T Craven, DDS; G Williams, DDS; B Bohaty, DDS, MSD, PhD

Children's Mercy Hospital and UMKC School of Dentistry, Kansas City Missouri



School of Dentistry

Children's Mercy Hospital and Clinics

## 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.<sup>1</sup> 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.<sup>4</sup> 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.<sup>11</sup> 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 <sup>1</sup>	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 studies<sup>1-10</sup> were included in this systematic review. Five<sup>1,2,3,6,8</sup> 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 study<sup>4</sup> utilized a prototype, vibration toy in the shape of a fish versus the conventional study whereas, two studies<sup>7,9</sup> similarly compared the conventional method versus the use of DentVibe™. Finally, two studies<sup>5,10</sup> compared the conventional method, a computerized delivery system and Dentvibe™. Of those ten studies seven<sup>1,2,3,4,6,8,9</sup> 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<sup>7,10</sup> reported that patients experienced no difference in perception of pain nor anxiety between the different methods of local anesthetic delivery. One study<sup>10</sup> 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

## REFERENCES

1. Suohu, Thejavino et al. "A Comparative Evaluation of Pain Perception and Comfort of a Patient Using Conventional Syringe and Buzzy System." *International journal of clinical pediatric dentistry* vol. 13,1 (2020): 27-30. Doi:10.5005/ijp-journals-10005-1731
2. Sahithi V, Saikiran KV, Nunna M, Elicherla SR, Challa RR, Nuvvula S. Comparative evaluation of efficacy of external vibrating device and counterstimulation of child's dental anxiety and pain perception during local anesthetic administration: a clinical trial. *J Dent Anesth Pain Med.* 2021 Aug;21(4):345-355.
3. Jain, Nivedita et al. "Efficacy of external cold and a vibrating device in reducing pain and anxiety during local anesthesia." *Journal of family medicine and primary care* vol. 10,11 (2021): 4017-4022. doi: 10.4103/jfmpc.jfmpc\_305\_21
4. Hegde KM, R N, Srinivasan I, D R MK, Melwani A, Radhakrishna S. Effect of vibration during local anesthesia administration on pain, anxiety, and behavior of pediatric patients aged 6-11 years: A crossover split-mouth study. *J Dent Anesth Pain Med.* 2019 Jun;19(3):143-149. doi: 10.17245/jdapm.2019.19.3.143. Epub 2019 Jun 30. PMID: 31338420; PMCID: PMC6620534.
5. de Camargo Smolarek P, da Silva LS, Martins PRD, da Cruz Hartman K, Bortoluzzi MC, Chibinski ACR. The influence of distinct techniques of local dental anesthesia in 9- to 12-year-old children: randomized clinical trial on pain and anxiety. *Clin Oral Investig.* 2021 Jun;25(6):3831-3843. doi: 10.1007/s00784-020-03713-7. Epub 2021 Mar 14. PMID: 33715064.
6. Alanazi KJ, Pani S, AlGhanim N. Efficacy of external cold and a vibrating device in reducing discomfort of dental injections in children: A split mouth randomised crossover study. *Eur Arch Paediatr Dent.* 2019 Apr;20(2):79-84. doi: 10.1007/s40368-018-0399-8. Epub 2018 Dec 5. PMID: 30519955.
7. Felemban O, Oghli AR, Alsaati I, Alattas LK, Olwi AM, Bagher SM. The effect of DentalVibe on pain and discomfort during local anesthesia in children: a randomized clinical trial. *Quintessence Int.* 2021;0(0):434-443. doi: 10.3290/j.qi.b912695. PMID: 33491390.
8. Bilsin E, Güngörmüş Z, Güngörmüş M. The Efficacy of External Cooling and Vibration on Decreasing the Pain of Local Anesthesia Injections During Dental Treatment in Children: A Randomized Controlled Study. *J Perianesth Nurs.* 2020 Feb;35(1):44-47. doi: 10.1016/j.jopan.2019.06.007. Epub 2019 Sep 26. PMID: 31564620.
9. Hassanein PH, Khalil A, Talaat DM. Pain assessment during mandibular nerve block injection with the aid of dental vibrate tool in pediatric dental patients: a randomized clinical trial. *Quintessence Int.* 2020;51(4):310-317. doi: 10.3290/j.qi.a44145. PMID: 32080686.
10. Smolarek PC, da Silva LS, Martins PRD, Hartman KDC, Bortoluzzi MC, Chibinski ACR. Evaluation of pain, disruptive behaviour and anxiety in children aging 5-8 years old undergoing different modalities of local anesthetic injection for dental treatment: a randomised clinical trial. *Acta Odontol Scand.* 2020 Aug;78(6):445-453. doi: 10.1080/00016357.2020.1757752. Epub 2020 Apr 29. PMID: 32348168.
11. Elicherla SR, Sahithi V, Saikiran KV, et al. Local Anesthesia in Pediatric Dentistry: A Literature Review on Current Alternative Techniques and Approaches. *J South Asian Assoc Pediatr Dent* 2021;4(2):148-154.
12. Moher D, Lierati A, Tetzlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Ann Intern Med* 2009;151(4):264-9, W64.
13. Downs SH, Black N. The feasibility of creating a checklist for the assessment of the methodological quality of both of randomised and non-randomised studies of health care interventions. *J Epidemiol Commun Health* 1998;52(6):377-84.