Vibration associated with cryotherapy to relieve pain in children

Vibração associada à crioterapia no alívio da dor em crianças

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ABSTRACT

BACKGROUND AND OBJECTIVES: The administration of intramuscular drugs and peripheral venous puncture are procedures that use needles cause pain, especially in children. This painful experience generates distress, phobia, tachycardia, refusal to further treatments, anxiety, and sadness in parents. The use of non-pharmacological methods such as vibration and cold for pain relief in children has become a reliable alternative. The objective of this study was to evaluate the association between vibration and cryotherapy as a strategy for the relief of pain in children undergoing procedures with the use of needles.

CONTENTS: This is an integrative review, in which articles were searched in the Pubmed, Medline, BDENF and LILACS databases, using the descriptors: “Child”, “Vibration”, “Cryotherapy” and “Pain” associated with the Boolean operator “and”. After the selection and reading of the articles in full, they were systematically synthesized and classified with a level of scientific evidence 2. Studies have shown that the association between vibration and cryotherapy is effective in reducing pain in children with or without cognitive alterations, also reducing their and parents’ anxiety during procedures performed with needles.

CONCLUSION: The implementation of vibration associated with cryotherapy during the administration of injectable drugs and the installation of a peripheral venous device can reduce the fear, anguish, and anxiety in children, calming the parents and benefiting health professionals.

Keywords: Child, Cryotherapy and pain, Vibration.

INTRODUCTION

Pain is defined as an unpleasant human experience related to the activation of the somatosensory nervous system after the occurrence of a real or potential injury¹. Invasive procedures that use needles, such as peripheral venipuncture and injection of drugs, including immunobiologicals, cause undesired psychological, physiological, and emotional effects on children, causing stress on family and health professionals². Child compliance and family agreement with the treatment are potentially compromised due to the need for procedures that cause discomfort and pain². The implementation of non-pharmacological measures to relieve the pain caused by needle procedures facilitates the continuity of treatment by the child due to the reduction of stress and distress in these patients³.
The use of vibration associated with low temperature (cryotherapy) as a non-pharmacological strategy to relieve the pain caused by needle procedures has been widely studied and is well accepted by the health team, the child and the family, as it decreases the occurrence of painful events, being easy to apply and considered a low-cost measure\(^5\).

The physiological mechanisms of pain relief provided by vibrating movements and cryotherapy are related to the sharing of synapses in the spinal cord. The nerve fibers conduction the pain stimulus shares the synaptic pathways with the thermal conduction fibers activated by thermoreceptors (temperature-sensitive) and with the mechanic conduction fibers, activated by mechanoreceptors (stimulated by the vibration). The interference of this interneuronal response inhibits the pain stimulus, causing relief\(^5\).

Studies have shown that the use of cryotherapy is effective in relieving the pain generated by the intravenous administration of botulinum toxin in patients with facial dystonia and women during labor\(^8\,9\). Vibratory stimulation has been shown to be beneficial in relieving muscle pain caused by intense physical exercise and during intravenous administration of local anesthetics in patients\(^10\,11\). Evidence points to the benefit of pain relief in children when combining vibration and cryotherapy in procedures using needles\(^3\,5\).

The motivation of the present study arose from the perception of a gap in critical reflections in the literature about the importance and effectiveness of cryotherapy associated with vibration as a non-pharmacological intervention to relieve pain, anxiety, and stress in children, caused by therapies that require the use of needles.

Therefore, this study aimed to evaluate the use of the association between vibration and cryotherapy as a strategy for pain relief in children undergoing procedures using needles.

**CONTENTS**

A bibliographic and descriptive study, characterized as an integrative review to identify and analyze, in scientific production, the use of vibration associated with cryotherapy to relieve pain in children. This study followed six methodological steps: 1. Determination of the theme and selection of the research hypothesis or question for the construction of the integrative review; 2. Elaboration of criteria for the selection of studies/samples; 3. Definition of the information to be extracted from the selected studies and categorization of the studies; 4. Evaluation of included studies; 5. Interpretation of the results and 6. Presentation of the review\(^12\).

This review was structured to answer the following guiding question: What is the effect of the association of vibration with cryotherapy to relieve pain in children undergoing needle procedures?

The literature search was performed in the Pubmed, Medline, BDENF (Nursing Database) and LILACS databases from November 2018 to March 2019, using the following controlled keywords: “Child”, “Vibration”, “Cryotherapy” and “Pain”, as well as their English correspondents, interconnected by the Boolean operator “AND”.

The inclusion criteria were published studies, with access to the full textual content that addressed the researched theme, papers with sample comprising children and adolescents (zero to 18 years old), and written in Portuguese, English, or Spanish. The exclusion criteria were review articles, experience reports, theses, dissertations, animal model studies and samples composed of adults. There were no restrictions based on year of publication.

After searching the databases, a total of 94 articles were found, which initially went through the selection and analysis steps in order to delineate the sample of the present review. The publications were selected in four interrelated stages. During the first round, articles that were not available with full-textual content (n=4) were excluded, and later, papers with duplicate databases (n=11) were eliminated. In the second-to-last stage, studies that did not address the study objective after reading the title and abstract (n=66) were excluded. Subsequently, the articles were carefully and critically read in their entirety using structured records in an adapted instrument, and, at this stage, five (n=5) papers were excluded due to the use of dental procedures in adults\(^5\). The study selection flowchart is shown in figure 1.

After selection, eight articles were included and coded in descending order of year of publication (N1 - N8) and systematically synthesized as to authors, year of publication, purpose, methods, strategies, and main results (Tables 1 and 2).
Table 1. Summary of studies included in the review

<table>
<thead>
<tr>
<th>Code</th>
<th>Authors</th>
<th>Origin</th>
<th>Objectives</th>
<th>Methods</th>
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<tr>
<td>N1</td>
<td>Bergomi et al.²</td>
<td>Italy</td>
<td>Evaluation of vibration associated with cryotherapy with or without the use of cartoons to relieve pain in children undergoing venipuncture. Evaluation of parents’ anxiety regarding these pain relief interventions.</td>
<td>150 binomials (5-12-year-old children and their parents) were randomly divided into four groups: 1. control group, which did not undergo any pain relief intervention, 2. Buzzy® group, 3. Buzzy® group associated with drawing and 4. cartoon group. All children underwent peripheral venipuncture.</td>
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<td>N2</td>
<td>Redfern, Chen and Sibrel²</td>
<td>United States</td>
<td>To determine if vibration associated with cryotherapy was able to relieve pain in children undergoing immunization.</td>
<td>Fifty children and adolescents (5-18 years old) were randomly divided into two groups: 1. group using Buzzy® and 2. group without the device, both submitted to immunization by intramuscular route.</td>
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<td>N3</td>
<td>Moadad et al.³</td>
<td>United States</td>
<td>To investigate the use of vibration and cryotherapy in pain relief during peripheral venous catheter insertion in children.</td>
<td>48 dyads (children aged 4 to 12 years and their mothers) were randomly divided into two groups: 1. control group (not exposed to Buzzy®) and 2. group using Buzzy®. Both groups were comprised children whose treatment required passing a peripheral venous catheter.</td>
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<td>N4</td>
<td>Schreiber et al.²¹</td>
<td>Italy</td>
<td>To test the effectiveness of using cryotherapy associated with vibration to relieve the pain induced by peripheral venipuncture in children with cognitive impairment.</td>
<td>71 children with cognitive impairment were randomly allocated to two experimental groups: 1. control, in which they were not exposed to Buzzy® and group 2 children submitted to Buzzy®. Both groups underwent peripheral venous device installation.</td>
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<td>N5</td>
<td>Canbulat Sahiner et al.¹⁴</td>
<td>Turkey</td>
<td>To determine the effect of cryotherapy associated with vibration in relieving the pain and anxiety triggered by immunization against diphtheria, tetanus, and infections caused by pertussis in children.</td>
<td>104 school-age children (up to 7 years old) were randomly divided into two groups by a computer program: 1. control group that was not exposed to Buzzy® and 2. group that was subjected to Buzzy®. The pain stimulus was established by the administration of the vaccine (DTP) to the deltoid muscle, 5cm above the site of the Buzzy® device.</td>
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<tr>
<td>N6</td>
<td>Canbulat, Ayhan and Inal²²</td>
<td>Turkey</td>
<td>Evaluation of the effect of cryotherapy associated with vibration on pain and anxiety in children undergoing peripheral venous catheter installation.</td>
<td>176 children aged 7 to 12 years were randomly divided into two groups using a computer program: a control group, which was not exposed to Buzzy® and the group with Buzzy®, 5cm above the peripheral venipuncture site.</td>
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<td>N7</td>
<td>Inal and Kelleci²³</td>
<td>Turkey</td>
<td>To investigate the effect of cryotherapy associated with vibration to relieve the pain and reduce the anxiety in children during blood collection for laboratory tests.</td>
<td>120 children from 6 to 12 years of age were randomly divided into two groups: 1. control group that was not stimulated with Buzzy® and group 2, with children submitted to Buzzy®, both groups underwent the installation of a venous catheter to collect blood.</td>
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<tr>
<td>N8</td>
<td>Baxter et al.¹⁹</td>
<td>United States</td>
<td>To test the effectiveness of cryotherapy associated with vibration in relieving pain and anxiety in children and adolescents undergoing peripheral venipuncture for blood collection.</td>
<td>81 children and adolescents aged 4 to 18 years were randomly divided into two experimental groups: 1. control group, which was not stimulated with Buzzy® and 2. group exposed to Buzzy®. Both underwent the installation of a peripheral venous catheter to collect blood.</td>
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Table 2. Summary of strategies and main results of the studies

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<th>Code</th>
<th>Strategies</th>
<th>Main results</th>
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<td>N1</td>
<td>The vibration associated with cryotherapy was induced by the Buzzy® device, whether or not associated with the cartoon. The perception of pain in children was assessed by the Wong-Baker faces scale, which was also used by nurses who performed the procedure. The nurses also assessed the pain in children using the emotional manifestation scale. Parents’ anxiety was assessed using the numerical scale from zero to 10.</td>
<td>The vibration associated with cold and cartoons minimized the pain in children submitted to venipuncture. These pain control interventions also contributed to reducing parents’ anxiety.</td>
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<td>N2</td>
<td>Vibrating stimulation and cryotherapy were established by Buzzy®. The pain was measured in the groups using the Wong-Baker faces scale, and a modification of this scale allowed the assessment of children’s anxiety. Parents’ satisfaction was investigated based on the experience with the study by applying a questionnaire and assigning a score that ranged from poor to excellent.</td>
<td>Anxiety showed no difference between the groups. The pain was much lower in the vibration and cold group compared to the control group. There was no statistical difference in the assessment of parents’ satisfaction between the groups.</td>
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Pharmacological measures that favor the reduction of pain perception with the use of drugs or with non-pharmacological measures, which are widely studied in children. Many non-pharmacological pain relief strategies are effective during the clinical management of hospitalized children, among them the use of therapeutic toys, the use of cartoon, non-nutritive sucking, and especially the association of vibration with cryotherapy.

The effectiveness of vibration and cryotherapy in reducing pain is related to the blockage of the afferent receptive nerve fibers to pain stimuli (A-delta and C fibers) and also to the stimulation of the non-nociceptive A-beta fibers, which activate the inhibitory interneurons reducing the conduction of the pain information to the spinal cord in the central nervous system. All studies (N1-N8) showed that the association of vibration with cryotherapy reduced the pain related to the use of needles during treatment in children. In addition, studies (N5, N6, and N7) also reported a reduction in the child’s anxiety during the procedure, which did not occur in study N2, which also evaluated anxiety during the procedure in these patients. Most studies (N1, N3, N5, N6, N7, and N8) used the Wong-Baker faces scale to assess the pain in children in different groups. Only one study modified this scale (N2), which

DISCUSSION

Needle procedures are the main causes of pain in children, especially in the age group from 5 to 10 years of age, and trigger behavioral, psychological, physiological and emotional changes that have a major impact on health, such as phobia, anxiety, tachycardia, sadness, and hormonal changes. Such events may compromise the drug therapy in these patients, especially the child’s resistance to future treatments, as well as the anxiety of the family and health professionals. The implementation of pain relief measures in children undergoing needle procedures is important and increasingly necessary, as it promotes the child and family compliance with subsequent treatments, reduces fear, and reframe the meaning of care. Pain relief can be achieved with the use of
adapted it to analyze the anxiety level in addition to pain in children. Study N4\(^2\) was the only study developed with children with cognitive impairment. Pain assessment in these children was performed using the pain verification scale in non-communicative children, in the surgery version\(^\text{2,3,14,18,22,23.}\) Other pain assessment scales were used in association with the Wong-Baker faces scale. In study N1\(^3\), nurses assessed pain in children through the emotional manifestation scale; study N6 used the visual analog scale, and studies N7\(^2\) and N8\(^1\) used the anxiety and pain scale. Study N5\(^14\) assessed the pain stimulus by the child’s verbal report.

Two studies investigated parent-related aspects of the participating children. N1\(^2\) assessed parents’ anxiety using a numerical scale ranging from zero to 10 and found that the parents’ anxiety was lower in the group of children with the Buzzy® device. Study N2\(^20\) assessed parents’ satisfaction using a structured questionnaire, but there was no difference between the groups of children with or without the device.

Family engagement is important and should be encouraged and implemented during the application of pain relief techniques in children, since family bonding is one of the main factors contributing to the child’s comfort and stress reduction, facilitating the professional’s job\(^6\).

CONCLUSION

The use of non-pharmacological measures for pain relief in children is a strategy well accepted by health professionals and parents when the child undergoes procedures that cause distress and pain. It was evident that vibration associated with cryotherapy reduced the pain and anxiety in children, with or without cognitive impairment, undergoing interventions that require the use of needles, and this fact explains the reduction of parents’ anxiety and the satisfaction of the health professionals.

REFERENCES


