The Clinical Effectiveness of Biofreeze® Topical Analgesic on Musculoskeletal Pain: A Systematic Review

Phil Page,1* and Lacy Alexander2

Background: Healthcare providers sometimes recommend topical analgesics instead of oral medication for temporary relief of musculoskeletal pain. Research suggests the mechanism of action of Biofreeze® is based on cryotherapy effect.

Purpose: The purpose of this systematic review was to describe the mechanism of action and determine the clinical efficacy of Biofreeze topical analgesic on musculoskeletal pain.

Study Design: This study uses a systematic review study design.

Methods: Electronic databases were searched for keywords such as “biofreeze” or “topical menthol”. Articles or abstracts on musculoskeletal pain outcomes were included. In total, 279 articles were screened and data were extracted from 9 studies meeting the inclusion criteria.

Results: Both statistical and clinically significant pain reduction were identified in studies of pain in the neck, back, and hand, whereas results were mixed for muscle soreness. Patients with knee pain had statistically significant reductions in pain that did not meet a clinically significant threshold. This review was limited by a lack of well-controlled clinical trials in large patient populations.

Conclusion: Biofreeze has been shown to provide clinically significant reductions in pain in several musculoskeletal populations.

Keywords: Biofreeze; topical analgesic; menthol; pain relief

Key Point: Clinically significant reductions in musculoskeletal pain using Biofreeze topical analgesic were found.

Biofreeze® topical analgesic (Performance Health, Akron, OH) is an over-the-counter topical analgesic commonly used to reduce pain in musculoskeletal conditions such as sprains, strains, and bruises. Biofreeze has been sold to consumers through healthcare providers (physical therapists, chiropractors, etc.) since 1991. Biofreeze is regulated by the U.S. Food and Drug Administration’s “final tentative monograph” on topical analgesics.1 The purpose of this systematic review is to discuss the mechanism of action behind Biofreeze and to determine its clinical efficacy in musculoskeletal pain.
MECHANISM OF ACTION

The mechanism behind Biofreeze pain reduction is considered to be through the cryotherapy method. The word *cryotherapy* is derived from the Greek words, *krýo* (cold) and *therapeía* (to cure). For the purpose of this review, *cryotherapy* will be defined as the use of localized cold therapy for treatment of musculoskeletal pain. Other forms of cryotherapy beyond the scope of this review include whole-body cold treatments and localized freezing of the skin for dermatological procedures.

Cryotherapy through the use of ice, cooling sprays, or topical analgesics, is often used for treating musculoskeletal injuries and pain. In general, there are 3 mechanisms for localized cooling of the body, which are as follows: physical cooling, evaporative cooling, and chemically mediated cooling. Each mechanism involves a reduction in skin temperature and/or stimulation of cold-sensitive receptors because of cold source applied to the skin.

Thermal receptors are sensory neurons located in the skin on subcutaneous nerves and blood vessels. Specific receptors for cold sensation, known as transient receptor proteins (TRP) are activated in response to a cold stimulus. These TRP receptors then send a “cold” signal to the thalamus via the spinothalamic tract where a cold sensation is perceived. This cold sensation induces a sympathetic response to maintain tissue temperature and protect tissues from excessive cold. Different subtypes of TRP receptors respond to different temperature ranges. In particular, the “TRP Melastatin 8” (TRP-M8) is sensitive to cold temperatures that are experienced during application of ice or menthol to the skin. TRP-M8 responds to temperatures ranging between 30°C and 8°C. In addition to temperature, the TRP-M8 channel is also sensitive to menthol, which is an ingredient in Biofreeze.

The following are the local effects of cryotherapy: decreased nerve conduction velocity; decreased sensation; decreased pain threshold; decreased skin temperature, arteriolar vasoconstriction; superficial vasodilation; and decreased tissue metabolism. When prolonged or subjected to very low temperatures, these effects can lead to side effects, such as such as pain, numbness, nerve damage, and frostbite, that are associated with direct ice application.

Menthol activates TRP-M8 receptors, creating a sense of cold from sensory neurons in the skin. The cryotherapy mechanism of Biofreeze is accomplished by stimulating these specific cold receptors in the skin. The localized cooling by Biofreeze also occurs through the evaporation of alcohol and menthol. Alcohol has a lower heat of evaporation and therefore transiently decreases skin temperature, thereby stimulating the cold receptors.

Arterial vasoconstriction is a sympathetic adrenergically mediated response to cryotherapy, reducing blood flow to the cooled area. Superficial cooling with ice application to the knee can reduce arterial blood flow by 38% in less than 5 minutes. Olive et al. found similar reductions in brachial artery blood flow when comparing the effect of the application of Biofreeze and an ice pack over the forearm. Both modalities significantly reduced blood flow by ~35% within the first 60 seconds of application.

In several other published studies, Topp et al. have shown that arterial blood flow significantly decreases within 20 minutes after the application of Biofreeze in the upper and lower extremities. Furthermore, the decrease in blood flow with Biofreeze is quantitatively equivalent to the decrease in blood flow with ice application (Table 1), thereby supporting the cryotherapy mechanism of Biofreeze. Figure 1 compares the average change in blood flow of ice and Biofreeze.

Topp et al. have also compared the side effects of Biofreeze and ice. Biofreeze application does not alter measurement of muscle strength 20–30 minutes after application compared with ice. Patients also noted less discomfort with Biofreeze application compared with ice. Bishop et al. reported
that patients with neck pain preferred Biofreeze to ice, 2:1.

Ice packs are applied directly to painful areas to reduce pain. Although traditional ice packs have potential side effects of pain, numbness, burns, frostbite, and reduced performance, Biofreeze provides the benefits of cryotherapy without the side effects of ice application.6,10

Both ice and over-the-counter topical analgesics are considered to reduce pain by depressing cutaneous sensory receptors1 through the gate control theory proposed by Melzac and Wall in 1965.14 The gate control theory suggests that pain signals from the periphery (carried through small “c-fibers”) are overridden by sensations carried by larger (A-delta) nerve fibers. Therefore, cryotherapy creates a cooling sensation that is perceived over a pain sensation. The TRP-M8 cold receptors discussed earlier have also been recently suggested to play a role in pain management.3,15

Although not well understood, temperature sensation and pain are related as they travel along similar nervous system pathways. Free nerve endings sense both temperature and pain; both pain and temperature travel up the spinal cord through the spinothalamic tract and end in the thalamus. In addition, the extremes of temperature (both hot and cold) produce pain sensations known as allodynia. Interestingly, patients with chronic pain often have hypersensitivity to temperature as well.

LITERATURE SEARCH METHODS
An initial literature search was performed in October 2015 for relevant articles using Academic Search Complete, CINAHL Complete, MEDLINE, and Sport DISCUS databases between the years 2003 and 2015. Search terms included “biofreeze” or “topical menthol”. An additional search of the research database for “Biofreeze,”

Figure 1. Percent change in arterial blood flow from baseline for 20 minutes after local application of Biofreeze and ice, based on research by Topp et al.6,10–12

Table 1. Decrease in arterial blood flow by time comparing ice and Biofreeze

<table>
<thead>
<tr>
<th>Study</th>
<th>1 min BF</th>
<th>1 min Ice</th>
<th>5 min BF</th>
<th>5 min Ice</th>
<th>10 min BF</th>
<th>10 min Ice</th>
<th>15 min BF</th>
<th>15 min Ice</th>
<th>20 min BF</th>
<th>20 min Ice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olive et al.9</td>
<td>−35%*</td>
<td>−35%*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topp et al.6</td>
<td></td>
<td></td>
<td>−42%*</td>
<td>2%</td>
<td>−19%</td>
<td>−22%</td>
<td>5%</td>
<td>−20%</td>
<td>7%</td>
<td>−48%*</td>
</tr>
<tr>
<td>Topp et al.10</td>
<td></td>
<td></td>
<td>−22%*</td>
<td>−24%*</td>
<td>−24%</td>
<td>−23%</td>
<td>−17%</td>
<td>−20%*</td>
<td>−17%*</td>
<td>−27%*</td>
</tr>
<tr>
<td>Topp et al.12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topp et al.11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>−35%</td>
<td>−35%</td>
<td>−26%</td>
<td>−11%</td>
<td>−21%</td>
<td>−21%</td>
<td>−6%</td>
<td>−20%</td>
<td>−5%</td>
<td>−38%</td>
</tr>
</tbody>
</table>

Note: *Indicates significant difference from baseline; # indicates averaged change between sides tested. Abbreviation: BF = Biofreeze.
www.Thera-BandAcademy.com, was then performed. Resulting articles were then screened by title and abstract for musculoskeletal pain outcome. Relevant articles were then reviewed for either inclusion or exclusion (Table 2).

RESULTS

Figure 2 provides a flowchart of the article selection process. The initial database search returned 228 articles; 51 additional articles from www.Thera-BandAcademy.com were added (279 for initial screening). In total, 106 non-journal/non-abstract articles and 71 duplicates were removed; 102 titles and abstracts were then screened for musculoskeletal outcomes in humans; 15 articles were analyzed for inclusion or exclusion; 6 articles were excluded because of nonexperimental design, case study, and 1 study was on a non-Biofreeze menthol analgesic. In total, 9 final articles (including full-text and published abstracts) were appraised (Table 3).

The 9 articles included studies that investigated various patient populations, including neck pain, back pain, knee pain, hand pain, and muscle soreness. All studies used the visual analog scale (VAS) as the main outcome for pain. Studies reporting change scores in VAS after applying Biofreeze were compared to the minimal clinically important difference (MCID) reported in population-based studies if available.

Table 2. Inclusion and exclusion criteria for literature review

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Study included Biofreeze® brand, a topical analgesic with &lt;5% topical menthol</td>
<td>• Non-Biofreeze/&gt;5% topical menthol used</td>
</tr>
<tr>
<td>• Musculoskeletal pain outcomes were measured</td>
<td>• Menthol combined with other class analgesics (capsaicin, salicylates)</td>
</tr>
<tr>
<td>• English language</td>
<td>• Non-English language</td>
</tr>
<tr>
<td>• Human subjects used</td>
<td>• Animal subjects</td>
</tr>
<tr>
<td>• Journal-published or abstracts from conference proceedings</td>
<td>• Case studies or non-comparison observational study</td>
</tr>
<tr>
<td></td>
<td>• Transdermal patch</td>
</tr>
</tbody>
</table>

Neck Pain

Bishop et al.13 compared the immediate effects of ice and Biofreeze in patients with noncomplicated bilateral acute neck pain. Either ice or Biofreeze was randomly applied to either side of the neck. Both modalities significantly reduced neck pain; however, the side on which Biofreeze was applied experienced a 2-fold reduction in pain compared with the side on which the ice was applied. Biofreeze application resulted in a change in pain averaging 2.6, whereas ice application reduced pain by 1.3 points on the VAS. The MCID in VAS pain score for neck pain;16 is 1.5 therefore, Biofreeze provided clinically relevant decreases in acute pain more so than ice.

Cervical manipulation can sometimes lead to post-manipulation soreness in patients with neck pain. Bishop et al.17 compared the effect of applying Biofreeze and a placebo gel after cervical manipulation in patients with mechanical neck pain. They found a significant reduction in soreness up to 20 minutes after the manipulation in the Biofreeze group, whereas no change was noticed in the placebo group. The authors did not specify the exact change in pain, so the clinical significance is unknown.

Back Pain

In a randomized controlled trial by Zhang et al.,18 36 patients with acute back pain underwent chiropractic spinal manipulation twice a week for 4 weeks. The subjects were
randomly assigned to either a control group (no additional treatment) or an experimental group in whom Biofreeze gel was applied to their back 3 times a day. After 4 weeks, the Biofreeze group experienced a statistically significant decrease in VAS pain (−2.77 points) compared with an increase in VAS (+0.77 points). The 67% reduction in pain was clinically significant, exceeding the MCID of 2 for low back pain.19

Transcutaneous electrical nerve stimulation (TENS) is an electrical modality used to reduce pain. Greenstein et al.20 randomly assigned patients with back pain receiving rehabilitation therapy to use TENS daily or Biofreeze 3 times a day (the length of the study was not mentioned in the abstract). In both groups, significant reduction in pain was observed, although the authors did not provide specific change scores. Although no true control group was used, the authors suggest that Biofreeze is as effective as TENS at reducing pain.

Knee Pain

Topp et al.21 evaluated the difference between Biofreeze and a placebo gel applied to 20 patients with knee osteoarthritis. The patients performed 5 functional tasks with each condition in a cross-over design with a 1-week washout period. They reported a significant reduction in VAS pain during 4 of 5 functional tasks with the Biofreeze gel compared with those in whom the placebo gel was used, averaging 27%–37% reduction in pain. The average reduction in VAS pain with Biofreeze was 0.9, which is less than the MCID of 1.99 established by Tubach et al.22

Hand Pain

Sundstrup et al.23 compared the effects of Biofreeze gel and a placebo gel on 10 slaughterhouse workers with symptoms of carpal tunnel syndrome. In their triple-blinded experiment, the researchers measured VAS at 1, 2, and 3 hours after application, separated by 48 hours. They found that the Biofreeze gel caused significantly more pain reduction than the placebo (VAS change of 1.3 in the Biofreeze group compared with 0.0 change in the placebo group), noting a moderate effect size of 0.63. Although the specific MCID for hand pain has not been established, the authors noted a marginal clinically significant change in pain with Biofreeze >1.0.24,25

Field et al.26 compared 20 patients with arthritis of the hand either receiving hand massage with a standard lotion or with Biofreeze. The subjects received massages once a week and continued self-massage at home during the week. After 4 weeks, both groups experienced significant decreases in pain, but the Biofreeze group experienced significantly

Figure 2. PRISMA flowchart of article selection and appraisal process
Table 3. Biofreeze clinical outcome studies on pain

<table>
<thead>
<tr>
<th>Study</th>
<th>Level&lt;sup&gt;b&lt;/sup&gt;</th>
<th>n-size</th>
<th>Participants</th>
<th>Study Design</th>
<th>Intervention</th>
<th>Outcome Measure</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bishop et al.&lt;sup&gt;13&lt;/sup&gt; 2011&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2</td>
<td>51</td>
<td>Acute neck pain</td>
<td>Randomized, concurrent treatment control, observational repeated measures</td>
<td>Subjects received either ice pack or BF on either side of their neck pain for 10 min</td>
<td>VAS before and after 10-min treatment</td>
<td>(S) pain reduction in both groups ($\Delta_{BF} = -2.59$, $\Delta_{Ice} = -1.3$) ($P &lt; .001$)</td>
</tr>
<tr>
<td>Bishop et al.&lt;sup&gt;17&lt;/sup&gt; 2012&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2</td>
<td>20</td>
<td>Mechanical neck pain</td>
<td>Randomized placebo-controlled, double-blind, observational repeated measures</td>
<td>Subjects received either BF gel or placebo gel immediately after neck manipulation</td>
<td>VAS at −5, 1, 10, 20, and 30 min after manipulation</td>
<td>(S) pain reduction with BF &lt; 20 min; no change with placebo ($P &lt; .0001$)</td>
</tr>
<tr>
<td>Ellis et al.&lt;sup&gt;26&lt;/sup&gt; 2005</td>
<td>2</td>
<td>11</td>
<td>DOMS</td>
<td>Randomized, placebo-controlled, double-blind, observational repeated measures</td>
<td>Subjects received either BF gel or placebo gel 4 times over 24 h, 24 h after DOMS induction</td>
<td>VAS at 24, 48 and 72 h after DOMS induction</td>
<td>(NS) pain reduction in BF group; (NS) between groups</td>
</tr>
<tr>
<td>Field et al.&lt;sup&gt;26&lt;/sup&gt; 2013&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2</td>
<td>20</td>
<td>Hand arthritis</td>
<td>Randomized, concurrent treatment control, repeated-measures clinical trial</td>
<td>Subjects received hand massage with lotion or hand massage with BF and home application for 4 wk</td>
<td>VAS before and after the first and last treatment session (weeks 1 and 4)</td>
<td>(S) pain reduction in both groups; (S) more relief in BF group ($\Delta_{BF} = -2$, $\Delta_{control} = -1$) ($P &lt; .05$)</td>
</tr>
<tr>
<td>Greenstein et al.&lt;sup&gt;20&lt;/sup&gt; 2013&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2</td>
<td>22</td>
<td>Back pain</td>
<td>Randomized, repeated-measures, clinical trial</td>
<td>Subjects received rehabilitation treatment and received either TENS daily or BF 3×/d</td>
<td>VAS before and after trial</td>
<td>Both groups (S) experienced decreases in pain ($P &lt; .001$)</td>
</tr>
</tbody>
</table>

(Continued)
<table>
<thead>
<tr>
<th>Study</th>
<th>Level(^b)</th>
<th>n-size</th>
<th>Participants</th>
<th>Study Design</th>
<th>Intervention</th>
<th>Outcome Measure</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johar et al.(^{27}) 2012(^a)</td>
<td>2</td>
<td>16</td>
<td>DOMS</td>
<td>Randomized, concurrent treatment control, observational repeated measures</td>
<td>Either BF or ice was applied to the biceps of subjects with DOMS 2 days later</td>
<td>VAS before and 2 days after induction at 20, 25, and 35 min after application</td>
<td>(S) pain reduction in BF group compared with control group ((\Delta BF = -1.9), ice = 0.8) ((P = .025)). Effect size = 1.2</td>
</tr>
<tr>
<td>Sundstrup et al.(^{23}) 2014(^a)</td>
<td>2</td>
<td>10</td>
<td>Carpal tunnel syndrome</td>
<td>Randomized, placebo-controlled, crossover, observational repeated measures</td>
<td>Subjects received either BF or placebo gel applied to forearm, 2 days apart</td>
<td>VAS at 1, 2, and 3 h after application</td>
<td>(S) less pain in BF group compared with control group ((\Delta BF = -1.3), (\Delta placebo = -0.0)) ((P = .009)). Effect size = 0.63</td>
</tr>
<tr>
<td>Topp et al.(^{21}) 2013(^a)</td>
<td>2</td>
<td>20</td>
<td>Knee osteoarthritis</td>
<td>Randomized, placebo-controlled, crossover, observational repeated measures</td>
<td>Subjects received either BF or placebo gel applied to knee before functional testing, 1 wk apart</td>
<td>VAS during 5 functional tasks</td>
<td>(S) less pain during 4 of 5 functional tasks using BF compared with that using placebo (average (\Delta BF = -0.9), (\Delta placebo = -0.4))</td>
</tr>
<tr>
<td>Zhang et al.(^{18}) 2008(^a)</td>
<td>2</td>
<td>36</td>
<td>Acute back pain</td>
<td>Randomized controlled, clinical trial</td>
<td>All subjects received spinal manipulation twice a week for 4 wk. The experimental group received BF 3×/d for 4 wk</td>
<td>VAS after each week of treatment</td>
<td>(S) reduction in pain using BF, whereas increase in pain in control group ((\Delta BF = -2.77), (\Delta control = +0.77)) ((P &lt; .05))</td>
</tr>
</tbody>
</table>

Notes: *Indicates an abstract only; (S) indicates statistically significant difference; (NS) indicates no statistically significant difference; \(\Delta\) indicates change in score; BF indicates Biofreeze; \(^a\)indicates a study supported by Biofreeze; \(^b\)study level is based on 2011 OCEBM.\(^{30}\)
more pain relief that was also clinically significant (2-point change on the VAS scale) compared with the group that received the standard massage treatment (1-point change on VAS).

**Muscle Soreness**

Johar et al.\(^27\) investigated the effectiveness of Biofreeze at reducing delayed onset muscle soreness (DOMS) in the biceps muscle of healthy subjects. They applied either Biofreeze or an ice pack to the muscle 2 days later and measured pain. The group receiving Biofreeze had significantly less soreness as measured on VAS than the ice group, noting 63% less pain (1.1 for Biofreeze versus 3.1 for ice). The pain in those in the Biofreeze group decreased by 1.9 points as measured on VAS compared with 0.8 decrease in pain for those in the control group. This was associated with a very large effect size of 1.2. The authors noted that the difference between groups was 2 points, indicating clinically significant reduction in pain among those in the Biofreeze group.

Ellis et al.\(^28\) induced DOMS in the quadriceps of 13 college students. They were randomly assigned either Biofreeze or a placebo gel 4 times over a period of 24 hours beginning 24 hours after DOMS was induced. They were assessed for pain at 1, 2, and 3 days afterward. Although there was a decrease in pain in those in the Biofreeze group compared with those in the control group, the difference was not statistically significant. The authors did not provide specific change scores for pain.

**DISCUSSION**

Overall, Biofreeze has been shown to effectively reduce pain at both statistically and clinically significant levels in a variety of musculoskeletal pain conditions. Although statistical significance can identify differences between 2 groups through hypothesis testing, statistical significance is of limited value for clinical outcomes. Clinically important differences relate to changes in patient outcomes that are worthwhile for the clinician and patient. An intervention may have statistical significance yet lack clinical significance. Clinical significance is often measured using MCID values for specific outcomes and populations.\(^29\) Figure 3 illustrates the change in VAS pain scores with Biofreeze in various musculoskeletal conditions in relation to clinically important differences.

All appraised studies were randomized and controlled comparisons. In total, 4 studies were placebo-controlled. Based on the Oxford Center for Evidence-based Medicine, each study was classified as a Level 2 study.\(^30\)

One study by Airaksinen et al.\(^31\) was not included in this review because it was not the Biofreeze brand; however, the main ingredient of the “cold gel” used in their study contained 3.5% menthol and 8% alcohol, similar to the components of Biofreeze. The prospective, randomized double-blinded controlled study was performed on subjects with soft-tissue injury. They applied either cold gel or a placebo gel for 14 days after injury. The researchers found significantly more and...
faster reduction in pain and disability and greater satisfaction in the group using the cold gel containing menthol.

Airaksinen et al.\textsuperscript{31} reported that 2 patients in each group (the cold gel and placebo gel groups) out of 74 total subjects (5\%) experienced "minor skin abrasion" after applying the gels to their skin. No Biofreeze study has described any side effects or adverse events. Although none of these clinical studies described adverse effects or side effects from participants, topical analgesics containing menthol may cause skin or mucous membrane irritation. Therefore, the use of Biofreeze is generally considered to be safe for its intended use when applied 3 to 4 times a day as recommended by the FDA.\textsuperscript{1}

This review has several limitations. Only 3 studies were clinical trials; the remaining were observational repeated-measures design. Most studies had small sample sizes, potentially leading to type II error. In addition, no study offered long-term follow-up. Unfortunately, nearly half (4/9) of the studies were only published as abstracts from conference proceedings. In addition to the heterogeneity of study populations, the lack of access to full articles limited the ability to evaluate the quality of these studies or to perform a full meta-analysis of the data, including determining overall effect size. Moderate to low PEDro scores\textsuperscript{32} were found for the following 3 studies: Topp et al.\textsuperscript{21} (5/10), Johar et al.\textsuperscript{27} (5/10), and Zhang et al.\textsuperscript{18} (3/10).

With the exception of 1 study,\textsuperscript{28} all studies were supported by the manufacturer of Biofreeze, but the studies were independently conducted. This may obviously introduce bias in these results, but there were no other available studies performed on Biofreeze. In addition, several studies lacked blinding or were combined with other interventions such as manipulation or massage, which may confound conclusions.

This review was limited by a small number of industry-supported studies with few full articles published in peer-reviewed journals. In addition, the studies were performed with relatively small sample sizes on a variety of conditions, making meta-analysis difficult. Future research should be independently performed to verify these results. In addition, larger clinical trials with follow-up should be published with accessible data.

CONCLUSION

Biofreeze has been shown to effectively reduce pain at both statistically and clinically significant levels in a variety of musculoskeletal pain conditions. The pain reduction provided by Biofreeze is considered to be achieved through the cryotherapy method, which is similar to ice. More research, including large randomized clinical trials in other patient populations, is warranted.

Financial Disclosure: Dr. Phil Page is employed by Performance Health, the manufacturer of Biofreeze as the Director of Research and Education, which may be a potential conflict of interest.

REFERENCES


