

Pain-free Dermatology: Minimizing Discomfort in Procedures for Children and Adults

It may be useful to review some of the techniques and approaches used to minimize pain.

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The concept of “pain-free pediatrics”—awareness and implementation of measures to alleviate pain and discomfort for children during procedures—has had a large impact on the field of pediatrics over the past several decades.¹ This was not always the case, however, with earlier textbooks making statements such as: “Pediatric patients seldom need medication for the relief of pain after general surgery. They tolerate discomfort well.”² Indeed, the rise of the child life specialist as an important part of many hospital teams is a testament to this change.³

Anecdotally however, “pain-free dermatology” does not appear to have achieved such widespread adoption. As many dermatologists care for children, it may be useful to review some of the techniques and approaches used to minimize pain, as these can improve both the patient’s experience and that of the practitioner as well. In addition, it turns out that many of these “pediatric” approaches appear to work nearly as well for children who have grown up: adults often appreciate these measures equally.

What makes striving for pain-free procedures so compelling is that everybody wins: the patients have less pain, the parents have less stress, and the practitioner has a smoother and easier procedure.

THE BASIS OF PAIN

Pain can be defined as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage.”⁴ While there have been many advancements in the understanding of the physiologic and pharmacologic aspects of pain,⁵ the basic tenants described in the 1960s

remain instructive: A[delta] fibers transmit localized, sharp pain sensations quickly, while C fibers send dull, more poorly localized pain sensations at a slower conduction velocity.⁶ More precisely, however, these nerve fibers are transmitting nociception, the painful stimulus alone, while pain itself involves the experiential aspect of those nociceptive signals as well. This is an important distinction as both pharmacologic and non-pharmacologic approaches have roles to play and will be discussed.

PHARMACOLOGIC APPROACHES TO PAIN CONTROL

Sucrose. As early as 1938 it was known that sucrose had a calming effect on a baby: “A sucker consisting of a sponge dipped in some sugar water will often suffice to calm a baby.”⁷ The science of sweet-tasting solutions for infant analgesia has progressed significantly, with a recent large review concluding: “Evidence from RCTs and systematic reviews supports the use of sweet solutions for pain reduction during painful procedures for infants...”⁸ The mechanism appears to work via opioid receptors, and while there are several commercial preparations available, simply moistening a pacifier with water and dipping it in table sugar can suffice.⁹ However, this technique only appears to work up until about 12 months of age.

Topical Anesthetics. There are many different topical anesthetics available, and all act by creating a reversible block of nerve conduction in pain fibers. This block, although almost always incomplete, can last from minutes to hours and is very safe, with limited potential for side effects.¹⁰

A well-known combination of two common anesthetics is referred to as “Eutectic Mixture of Local Anesthetics” and is composed of a 1:1 mixture of 2.5% lidocaine and 2.5% prilocaine. When mixed together, they melt at a lower temperature than they do separately, remaining a liquid at room temperature. When applied topically about 60 minutes before a procedure, it penetrates up to a depth of 10mm in the skin. This depth can be increased with occlusion, such as with a plastic wrap or adhesive dressing. While generally safe, there is a small risk of developing methemoglobinemia, which impairs the blood’s ability to deliver oxygen to tissue and, if untreated, can be dangerous. However, this is mostly a concern in patients less than three months of age and when using large amounts (>2 g per 10 cm² of body surface area).¹¹

A review of eight trials (n= 458 children) of painful procedures comparing tetracaine to the eutectic mixture of lidocaine and prilocaine found that both were comparable for pain relief, but that the tetracaine reached optimal effect in about half the time (30 min vs. 60 min) making it superior in this metric. Newer preparations of lidocaine utilize liposomes to enhance penetration and appear to match tetracaine’s faster onset with similar pain attenuation scores.¹²

The skin barrier function generally prevents optimal penetration of topical anesthetics, but there is a fortuitous circumstance that allows for near-immediate effect. Cryotherapy for warts is often painful for children and adults, and this pain has both an immediate and a delayed component. Applying a topical anesthetic (e.g., 4% lidocaine cream) immediately after freezing can render the lesion painless within 30 seconds.¹³ The theory is that ice crystal formation during freezing can damage the epidermal barrier, thus increasing penetration of the anesthetic immensely. This pearl can be very helpful in minimizing the delayed, throbbing pain component of cryotherapy.

Injectable Local Anesthetics. Injectable anesthetics remain the mainstay of dermatologic procedures. They are safe, work rapidly, and are very cost effective. However, there can be significant discomfort as they are injected, both from the needle puncture and the infiltration of the anesthetic into the skin.¹² While pre-treating with a topical anesthetic may help with the needle pain, the stinging and burning sensation from infiltration of the anesthetic is generally too deep for topical anesthetics.

The pH of lidocaine solution is between 3.5-7.0, and this acidity is thought to be responsible for the pain of infiltration. Alkalinization of the lidocaine can reduce this pain significantly. This is generally achieved by adding 1mL of 8.4% sodium bicarbonate to 9mL of 1% or 2% lidocaine. Buffering the lidocaine with sodium bicarbonate offers a clinically and statistically significant reduction in administration pain experienced by most patients.¹⁴ While there are theoretical issues with buffering such as possibly causing the lidocaine to precipitate out of solution,

decreasing the potency, and reducing the shelf life of the anesthetic, none of these were found in a large review of multiple studies.¹²

Aromatherapy. Although it may sound strange, in a mouse model it was found that inhalation of atlantic cedar oil markedly reduced mechanical hypersensitivity to painful stimulus. Remarkably, this effect was prevented by pre-treatment with naloxone, suggesting that it is mediated by opioid receptors.¹⁵ This study lays the foundation that odors may activate a descending pain modulation pathway and be of use for pain control.

A more relevant study examined 73 children with type 1 diabetes who had to perform frequent injections of insulin. Orange and lavender oil were dispersed in the room with an aromatherapy device and were compared to a placebo. The study found that a lower change in heart rate was associated with the aromatherapy group (p=0.0252), suggesting that aromatherapy may help with the autonomous response to pain.¹⁶ While it is difficult to extrapolate too far beyond this, the idea of a pleasant smelling treatment room—so long as the patient is not allergic to the essential oil, of course—is certainly appealing.

NON-PHARMACOLOGIC APPROACHES TO PAIN CONTROL

Cooling. Cooling the skin may decrease nerve conduction velocity of C and A[delta] fibers, thereby decreasing the transmittance of pain signals.¹⁷ In one study of 60 volunteers, no significant difference was found between using a buffered anesthetic solution and skin cooling in reducing the pain of infiltrating anesthesia, suggesting that cooling could be as effective as the pharmacologic effect of buffering.¹⁸

Another study randomized 39 patients before injecting anesthesia to skin cooling (termed “cryo-preparation”) or no skin cooling. The study found significant reduction in injection pain with cryo-preparation, with a 24.6% reduction in pain score that was statistically significant (p = 0.039).¹⁹

Another randomized, controlled clinical trial compared eutectic mixture of local anesthetics cream to a vapocoolant spray, and demonstrated equal efficacy for reducing immunization pain in children.²⁰

Cooling of the skin can be achieved in many ways, from evaporative refrigerant sprays such as ethyl chloride to a simple ice pack. One clever study compared ice cubes wrapped in latex or latex-like glove material to ice cubes wrapped in aluminum foil and found that the aluminum foil wrapping was more effective at reducing skin temperature before neurotoxin injection.²¹ After 120 seconds of exposure, only the aluminum foil wrap was able to achieve a 2°C skin temperature, which achieves the cold thought to be necessary to reduce nerve conduction and increase the pain threshold.²²

These studies support the notion that cooling the skin is a safe, inexpensive, and effective technique for minimizing a variety of types of pain.

Vibration. The application of vibration to the skin proximal to the procedure site has been shown to decrease pain perception during procedures for both adults and children. Though initially thought to work simply by distracting the patient from the procedure, it now appears that vibration physiologically mediates the transmission of painful stimuli under Melzack and Wall's Gate Control Theory of pain. Simply put, non-noxious nerve stimulation by vibration and temperature may actually suppress the transmission of painful stimuli.²³

One study of 20 neonates found that application of a vibration sensation during heel stick procedures reduced pain associated with the procedure (as measured by the Neonatal Infant Pain Scale) when the infants served as their own controls.²⁴ In adults, at least one study demonstrates vibration outperforming vapocoolant for pain reduction during venipuncture.²⁵

Vibration combined with cooling (available in a hand-held commercial device) is even more effective. Numerous studies demonstrate statistically and clinically significant reduction in pain perception when both are applied proximal to the painful procedure. One randomized prospective trial of 81 children who received standard therapy versus use of a device combining cooling and vibration found that not only were reported pain scores lower in the device group, venipuncture success was higher.²⁶ Similar findings have been shown even in children with cognitive impairment.²⁷

Distraction. Parents have known for years about the power of distraction by electronic devices. More recently, however, with the explosion of smart phones and tablet devices, it is now possible to exploit the power of electronic distraction to reduce procedural distress. Some of the earliest reports grew from attempts to reduce pre-operative distress for children undergoing both painful and anxiety-producing procedures. Case reports described reduced anxiety during induction of anesthesia,²⁸ dental procedures,²⁹ and laceration repair in the emergency department.³⁰

Remarkably, the use of electronic devices has even been shown to out-perform sedative medications. In one randomized study of 112 children undergoing elective surgical procedures, children who were given a hand-held video game in the pre-operative setting were found to be significantly less anxious than children who received comfort from their parents or children who received intravenous midazolam.³¹ Though the literature has focused largely on procedures in the operating room, emergency room, and dental office, using these techniques is readily applicable to the office setting for the dermatologist.

SUMMARY

A smooth and comfortable procedure is incredibly satisfying. The opposite: a screaming, thrashing, hysterical child and frazzled parent, can figuratively take years from a practitioner's life. Pain-reduction methods, both pharmacologic and non-pharmacologic, have real effects on patient comfort and almost certainly influence the outcomes of procedures. Integrating these into daily practice can take some work and may cost some time and money, but the benefits seem to greatly outweigh these factors, and the results suggest one of the rare situations where everybody wins. ■

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