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A review of non-pharmacologic approaches to enhance the patient experience in dermatologic surgery

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Abstract

Efforts to increase patient comfort by minimizing pain and anxiety have been shown to improve clinical outcomes, reduce pain thresholds, decrease analgesic requirements and complication risk, strengthen the physician-patient relationship, and increase overall patient satisfaction. Patients also have a strong preference for patient-centered communication and educational discussion with physicians. In recent years, the increasing emphasis on patient experience scores as a metric for quality care has had significant implications for physician practice and has reinforced attempts to provide more patient-centered care. Though different pharmacologic agents and techniques have been extensively reviewed in the dermatologic literature, there have been few studies of non-pharmacologic strategies for improving patient-centered care. This evidence-based review describes alternative techniques that have been suggested for use in dermatologic surgery. Mechanoanesthesia, cold therapy, verbal and audiovisual distraction, music, optimal needle insertion methods, hypnosis and guided-imagery, perioperative communication, and educational strategies have been reported to improve the patient experience in dermatologic surgery. These interventions are often cost-effective and easy to implement, avoid medication side effects, and serve as adjunct approaches to enhance patient comfort. This review examines the corresponding evidence for these nonpharmacologic strategies to provide a clinical resource for the dermatologic surgeon seeking to optimize the patient experience.

pharmacologic, patient experience, patient satisfaction, patient comfort, anxiolysis, patient communication, patient education

Introduction

Patients undergoing invasive procedures may experience elevated levels of pain and anxiety [1-4]. Factors that can contribute anxiety are the risks associated with the procedure, fear of pain, fear of harm or disfigurement, separation from family and friends, and an unfamiliar environment [5]. Patient stress can also be triggered by sight of the operating room, the surgeon's touch, and administration of anesthesia [6]. In a survey of 300 adults who had recently undergone various surgical procedures, with over half in the outpatient setting, the primary pre-surgical concern reported was post-surgical pain and 46% of patients expressed high anxiety levels about pain before the surgery [7].

Preoperative anxiety has been shown to reduce pain thresholds and increase pain intensity estimates; it is a significant predictor for intraoperative and postoperative pain [6, 8-10]. A higher baseline anxiety can also increase analgesic requirements and risk of complications, as well as prolong recovery [1, 2, 5]. Patient anxiety during dermatologic surgery has specifically been associated with inferior outcomes. In a study of 356 Mohs micrographic surgery patients, individuals with heightened anxiety toward pain before surgery experienced significantly greater postoperative pain [11]. Therefore, attempts to minimize patient anxiety may promote patient relaxation, lead to decreased

Keywords: dermatologic surgery, dermatology, non-

perceived pain, improve clinical outcomes, and decrease the costs of care.

Efforts to promote comfort and improve the surgical experience are also essential to strengthen the patient-physician relationship and increase patient satisfaction. These efforts are having an increased impact on physician practice. Patient experience scores are being utilized as proxy for healthcare quality and higher patient experience scores have correlated with higher quality of care [12, 13]. Patient-reported scores may impact reimbursement, the maintenance of certification, patient retention and referral rate, and even malpractice risk [12, 14-16]. Furthermore, the increased emphasis on patient satisfaction has led to greater transparency of care. Online rating platforms make individual patient experiences and perceptions publicly available, which can influence patient decision-making.

This review will focus on studies with implications for creating a more positive patient experience during dermatologic surgery. There has been extensive review of pharmacologic methods to reduce pain and anxiety. However, there has been limited discussion of non-pharmacologic approaches to enhance patient comfort in dermatologic surgery. Often cost-effective and easy to implement, these alternative techniques may provide additive therapeutic benefit, reduce pharmacologic demand and complications, and promote a more patient-centered experience. The clinical implications of various strategies suggested in the dermatologic and other pertinent literature will be presented and discussed, with an emphasis on level of evidence to provide a clinically useful resource for dermatologic surgeons looking to improve on patient-focused care techniques.

Discussion

Non-pharmacologic interventions

There is no evidence for a single preferred method for promoting patient-centered care, but various studies suggest diverse strategies for improving the patient experience in ambulatory cutaneous surgery [3, 17-20]. Within the specialty of dermatology, most

published articles addressing patient pain and anxiety highlight pharmacologic interventions. Many different agents and delivery methods have been developed to optimize patient safety and comfort. Numerous articles have put forth comprehensive reviews of different pharmacologic agents, preparations, and methods of administration for use in dermatologic surgery [21-35].

Although there is a wealth of knowledge and research regarding the use of pharmaceutical agents to manage pain and anxiety, other non-pharmacologic modalities have been investigated to improve the patient experience during cutaneous surgery. Medications may carry undesirable side effects, prolong recovery, or provide inadequate therapeutic relief [2]. In a randomized controlled trial of 61 patients undergoing outpatient same-day surgery, there was no significant difference in anxiety scores with patients receiving benzodiazepine premedication when compared to placebo [36]. Another survey of 200 patients undergoing elective surgery found that the majority did not want excessive sedative medication to reduce their anxiety but would rather read, listen to music, or chat with other patients while waiting to go into the operating room [37]. For outpatient dermatologic surgery, non-pharmacologic interventions such as distraction methods, needle insertion techniques, relaxation strategies, and specific patient communication and education techniques have been utilized to enhance the overall patient experience ([Table 1](#)).

Distraction Techniques

Local anesthetic administration can be a traumatic and anxiety-provoking experience and is often cited as the most painful aspect of minor procedures [38-40]. The pain resulting from administration of local anesthetics may provoke intense distress and may be attributed to the puncture of the skin, tissue irritation from the anesthetic agent, and tissue distension from infiltration [21]. Decreasing the pain of local anesthesia delivery is a constant goal in dermatologic surgery and is especially beneficial in children [24].

Distraction is a method of cognitive refocusing, which diverts attention from pain to more pleasant

stimuli, thus reducing the perception of pain [41]. The gate control theory describes the mechanism by which the perceived pain conveyed by C fibers is inhibited from reaching the cortex by inhibitory interneurons, which modulate the competing input from A delta fibers [42-44]. Physical stimuli can include stretching, scratching, pinching, vibration, and cooling. Distraction can also include conversations, audiovisual diversion, and background music (Table 1).

Mechanoanesthesia

Different forms of mechanical stimulation have been described to reduce injection pain. These stimuli increase the "sensory noise" perceived by the brain in the area of the needle stick [40]. First reported in 1984, mechanoanesthesia through vibration has been described to safely and effectively diminish pain and reduce discomfort in patients prior to undergoing dermatologic procedures [43-47]. Although predominately suggested in the literature through expert opinion, small-scale randomized controlled trials have reported statistically significant pain reduction and patient preference with vibration anesthesia during injections [47, 48]. Recently, a randomized, self-controlled study of 53 patients observed significantly decreased visual analog scale pain scores when co-administering vibration therapy during botulinum toxin A injections (3.6 versus 5.6, $P=0.000$) [49].

Other forms of mechanoanesthesia include touch, pinching, and scratching the skin [6, 41, 50, 51]. In one non-dermatologic randomized controlled trial (N=80), patients undergoing minimally invasive venous surgery were instructed to handle stress balls when experiencing intraoperative discomfort [6]. Significant reduction was found in pain and anxiety ($P<0.01$, for both outcomes). A separate randomized controlled trial (N=103) in a dermatology setting found that repetitive pinching of the skin during lidocaine infiltration significantly reduced discomfort with median visual analog scale scores of 2 versus 3 (vibration versus control, respectively; $P=0.03$) [50]. Although massage and acupuncture have been studied for applications in scar healing and outpatient therapy for various skin conditions,

there are currently no investigations for uses to reduce discomfort within the perioperative setting [52-54].

Cold anesthesia

Using ice, gel cold packs, cold air, or cryoanesthesia before needle injection have been suggested in multiple dermatologic articles to significantly decrease the discomfort of needle puncture [55-59]. One randomized controlled trial in dermatologic surgery patients (N=20) comparing topical lidocaine-prilocaine cream, also known as Eutectic Mixture of Local Anesthetics (EMLA), and ice for injections of 0.1cc of 1% lidocaine with 1:100,000 epinephrine using a 30-gauge needle showed a statistically significant reduction in visual analog scale pain scores with both the topical anesthetic and ice compared to the control ($P<0.01$ in both), [60]. Although patients perceived a greater effect from the EMLA, average visual analog scores between interventions were similar (0.8 versus 1.2, EMLA and ice, respectively). Investigating the use of cold air in various cutaneous procedures, a randomized crossover trial observed reduction of visual analog scale pain scores in 33 of the 40 patients [58]. Cold therapy has also been found to have additive analgesic properties in dermatologic surgery patients when used in combination with other topical lidocaine anesthetics [55, 56].

Cold anesthesia has been studied more extensively in small trials for uses in patients receiving botulinum toxin injections in hyperhidrosis [61]. One study comparing EMLA versus ice in 23 patients receiving botulinum toxin injections for palmar hyperhidrosis reported a greater reduction in average visual analog scale pain scores with ice compared to the topical anesthetic (4.8 versus 8.9, respectively; $P<0.05$), [62]. Furthermore, the authors indicate that EMLA is expensive and needs to be occluded to skin for 1-2 hours for optimum results, whereas ice is a readily available, inexpensive, and a fast-acting alternative. Cryoanesthesia with dichlorotetrafluorethane has also produced significant reductions in injection pain for palmar hyperhidrosis [63, 64]. Yet, three dermatologic controlled studies (N=36, 24, 23) did not find a clinically significant benefit with skin cooling or gel packs for botulinum toxin injections

[55, 65, 66]. Potential explanations for the minimal analgesic effect in these studies may be related to decreased efficacy in the facial region [55], or the requirement for extended administration of multiple injections for hyperhidrosis [65].

Verbal distraction

The use of verbal distraction through conversation or comforting words has been proposed in descriptive articles for possible therapeutic benefit in the dermatologic surgical setting [19, 38, 67]. A randomized controlled trial of non-dermatologic ambulatory surgery (N=78) reported a significant decrease in the average 10-point numeric rating scale scores of intraoperative pain and anxiety with conversational interaction with nurses when compared to a control (0.68, $P < 0.05$ and 1.34, $P < 0.001$, respectively), [6]. However, randomized controlled trials studying "talkesthesia" in the dermatologic surgery setting have not yet been done, so use of this technique is only supported by expert opinion-level evidence.

Audiovisual media

Although evidence within dermatologic surgery is limited, audiovisual interventions have been widely used in other surgical subspecialties [68]. Distraction by means of audiovisual stimuli has been shown to significantly decrease anxiety when used before or during elective ambulatory surgery in non-dermatologic studies and may be particularly beneficial in children who may be more frightened by minor surgical procedures [6, 69, 70]. A systematic review of 14 randomized controlled trials and 4 nonrandomized controlled studies for pediatric subjects undergoing elective surgeries concluded that audiovisual interventions with videos, multifaceted programs, and interactive games appear to be most effective in reducing children's preoperative anxiety, whereas studies investigating music therapy and internet programs showed minimal effect [71]. A separate Cochrane Database review that included 28 randomized controlled trials of non-pharmacological interventions also supported this finding and found that children allocated to interventions with video games before induction were also significantly less anxious when compared to children who were sedated with midazolam

(modified Yale Preoperative Anxiety Scale mean difference -12.20, 95% confidence interval -21.82 to -2.58), [72]. Further studies are necessary to assess the impact on reducing pain and anxiety within dermatologic surgery.

Music

Studies investigating the effects of music on preoperative anxiety have produced conflicting results. Music has been extensively reviewed in the literature in many different disciplines but remains controversial regarding the presence of any anxiolytic benefit. One randomized controlled trial (N=100) in dermatologic surgery reported a reduction in patient visual analog scale anxiety scores compared to the control (3.2 ± 1.6 versus 0.66 ± 0.73 , $p < 0.001$) with music in Mohs micrographic surgery, whereas in another smaller scale trial (N=8) 75% of patients reported that listening to their choice of music positively affected their perception of the Mohs surgical experience [5, 73]. The decreased anxiety via personalized music for Mohs surgery patients was also shown to improve intraoperative responsiveness to directions and diminish the risk of complications related to unexpected patient movement [73].

Other trials and systematic reviews in dermatologic and non-dermatologic surgery have not found any significant anxiolytic effect from music [9, 72, 74-76]. Various factors may influence the efficacy of music therapy. Data from studies supporting music therapy indicate that therapeutic effects are more likely to occur when patients are allowed to select the music. In addition, music with a slow tempo and a regular beat, music played on instruments such as the piano or the flute, music administered through headphones or open speaker devices, and music used intra- or post-operatively are most beneficial [77-80]. Studies suggest that music engages the patient's mind and diverts attention to pleasurable emotional states, promotes relaxation through decreasing adrenergic activity, and affects the limbic system by decreasing neurotransmitter signaling pathways and triggering the release of endorphins [4, 79, 81-83]. Patient choice appears to have a major influence in the effectiveness of music. The results of one systematic review of elective surgeries indicated that some

patients preferred to not have music as a distractor, whereas those who did desired to personally select the music [4]. For example, some patients may prefer to watch television, read, knit, or talk with friends or family members while they await surgery [84]. Although music is a relatively inexpensive modality to implement with a low risk of side effects and potential benefits, clear evidence of significant decrease in patient anxiety is lacking and further investigation for uses in dermatological settings is warranted.

Needle insertion method

Different injection techniques may impact the subjective pain levels experienced by dermatologic patients. One dermatologic randomized, controlled crossover trial (N=65) observed statistically significant lower pain scores of a local anesthetic injection with a 90-degree angle when compared to a 45-degree angle ($P=0.0002$), [85]. However, the overall mean numeric rating scale pain score difference of 0.4 was relatively small. The authors hypothesize that less pressure is required to inject at 90 degrees, resulting in less tissue distension and pain stimuli. Yet, a subsequent study of 146 Mohs surgery patients using a parallel insertion technique with comparable needle size and local anesthetic reports more improved pain scores than the previously mentioned study, with mean visual analog scale scores <1.0 out of 10 [86]. Thus, although not currently clear which method is superior, these studies demonstrate a varied pain response with different needle insertion angles.

With regard to needle size, a single-blinded randomized controlled trial found that pain was further diminished by use of a finer 33-gauge needle, with 77% and 94% of dermatologic patients feeling no pain of needle insertion in the face and scalp, respectively, as compared to 64% and 54% of control patients receiving a 30-gauge needle ($P=0.027$ and $P=0.005$, respectively), [87].

Relaxation Strategies

Mind-body therapies, such as hypnosis and guided therapies, have been utilized in the dermatologic surgery setting to calm and rebalance the autonomic nervous system, thereby decreasing anxiety in patients ([Table 1](#)). Although other mind-body

therapies, such as controlled breathing, progressive muscle relaxation, affirmations, journal writing, and biofeedback have been suggested in descriptive articles, there is no available objective data from clinical trials [3, 53, 88].

Hypnosis

Hypnosis was first discussed in the literature for use in dermatology in 1955 and has since been reviewed in multiple descriptive articles [89-94]. Clinical evidence within dermatologic surgery is limited to one randomized controlled trial (N=39) that observed a significant reduction in numeric rating scale anxiety scores (1.0 versus 2.64 control, $P=0.033$) and a case report that demonstrated an effective application of hypnosis to decrease anxiety and discomfort [67, 95]. Within other surgical specialties, hypnosis has also been shown to be a beneficial therapy. In two randomized controlled trials (N=241, N=161) of interventional radiology procedures, hypnotic relaxation led to significant decreases in pain, anxiety, hemodynamic instability, and procedure time and costs when compared to controls [96, 97]. In plastic surgery, two randomized controlled trials (N=337, N=60) also showed significant reduction in peri- and post-operative pain and anxiety, decreased sedative requirements, more stable vital signs, and higher patient satisfaction [98, 99]. In another randomized controlled trial (N=50) of pediatric non-dermatologic surgery patients, the difference in anxiety upon facemask placement between the hypnotherapy and control group reached statistical significance ($P=0.04$), [100]. Although live rapid induction hypnosis requires no experience on the part of the patient, special training and experience are necessary for the provider, although recorded hypnosis inductions have been proposed [101].

Guided imagery

Guided imagery is a meditative process in which a patient visualizes or imagines things to achieve a state of deep relaxation [74]. Similar to hypnosis, this therapeutic intervention can be facilitated by an individual or a recording but may also be self-directed. A single-blinded randomized controlled trial of recorded guided imagery in cutaneous surgery recorded no significant difference in patients

pain, anxiety, and blood pressure, but did note a significant decrease in surgeon anxiety compared to the control group ($P < 0.05$), [74]. However, a cohort study ($N=56$) of interventional radiology patients found that the use of pre-recorded tapes or provider-directed imagery was less effective than self-directed imagery, but the study provided insight on types of imagery used [102].

Patient-centered communication

Effective patient-centered communication is integral to achieving high patient satisfaction. One observational study of 722 dermatologic patients found that the most important factor related to a positive patient experience was the physician's ability to communicate, which specifically involved listening to patients, explaining well, and showing concern [103]. Another survey study of 396 dermatology outpatient appointments revealed that overall patient satisfaction was significantly increased by the physician's ability to give explanations and to show empathy for patients [103]. From this cohort of patients, self-reported adherence to prescriptions was reported to be lower when the patients were dissatisfied with their care [104].

The increasing demands on time can lead to physicians rushing patient encounters without eliciting all concerns and clarifying information, resulting in patients feeling dissatisfied with their care. However, patient-centered communication skills can optimize the physician-patient relationship without significantly prolonging office visits and can even lead to increased efficiency [105]. Although one study surveying patients from 394 dermatologic office visits noted that spending more time with patients and setting expectations improved the patient experience [106], other studies have shown that increasing the visit time does not significantly affect a patient's experience when controlling for physician interpersonal skills [103]. This suggests that a patient's perceived time spent with physicians may be more impactful for a positive experience than the actual time spent [17]. Thus, providers may benefit by focusing less on time spent and more on maximizing the time with the improvement of

interpersonal skills and attention to the physician-patient relationship.

Suggestions for more patient-focused communication described in dermatologic review articles include sitting down at patient's eye level, allowing patients to write down their expectations of the visit, eliciting the full spectrum of concerns, using reflective listening, recording a personal detail in the visit note, avoiding rushing to the diagnosis, engaging patients in relevant parts of the computer screen or minimizing computer use, and showing empathy by acknowledging patient emotions [18, 105]. Additionally, clearly discussing a particular treatment, offering options reinforced by evidence and the physician's experience, and allowing the patient to take an active role in the decision-making process can result in an improved experience [17]. A prospective cohort study of patients undergoing Mohs surgery found that patients who were involved in the decision-making process had higher postprocedural satisfaction [107].

In dermatologic surgery, patient expectations of procedures and their outcomes are important determinants of satisfaction. Patients have been shown to have misconceptions about dermatologic procedures, including the appearance of scars, recovery period, or risks of laser procedures [108, 109]. Some predictors, such as female gender and younger age, have been shown to correlate with a higher risk for cosmetic anxiety and can be taken into consideration in the pre-operative planning [110]. Although there is no strict algorithm to follow in the pre-operative evaluation for dermatologic surgery, an evaluation may be individualized in order to build patient-physician rapport and trust, identify potential problems so they can be addressed prior to surgery, confirm and establish diagnoses and treatment approaches, provide an avenue for patient education, and ensure better outcomes for both the surgeon and patient [111]. A frank discussion allows for clearly providing information and preventing anxiety about side effects, complications, and duration of recovery. Some patients can be unprepared for post-operative wound care if not specifically discussed [112]. Regarding the timing of the consultation, one retrospective study ($N=100$)

found that 67% of dermatologic surgery patients preferred same-day versus separate-day consultation [113]. Another study found no benefit regarding patient anxiety or satisfaction with an additional pre-operative phone call for patients undergoing same-day consultation for Mohs surgery [114].

Communication strategies intra-operatively are less discussed in the scientific literature. Although handholding and talking during painful procedures may be helpful, some authors believe that these may not provide sufficient relief [44, 115]. Conversely, descriptive and technical language from the medical team may evoke vivid imagery and anxiety. To address this concern, Fulchiero et al. provided suggestions for nonverbal hand signals that can be used during dermatologic surgery to minimize the amount of technical-based verbal communication and allow the surgical team to talk to the patient to ease anxiety and increase patient satisfaction [116].

Anxiety in dermatologic surgery patients may persist for prolonged periods postoperatively, as one study of 173 patients undergoing Mohs surgery of the face did not report a clinically relevant improvement in cosmetic anxiety visual analog scores until one week postoperatively [110]. Furthermore, mean cancer anxiety scores also remained within preoperative standard deviation limits until three months after surgery. A retrospective study (N=97) of cutaneous surgery observed that 89% of patients considered post-operative follow-up important, with the majority opting for follow-up within four months and nearly a third preferring follow-up within two to three months [117]. The reasons for desiring follow-up were to ensure the wound healed well (50% of respondents), to ensure the cancer had not returned (27.9%), and to examine the rest of the skin (18.6%). Post-operative telephone calls have also been suggested as a cost-effective, time-efficient way of achieving high levels of patient satisfaction after Mohs surgery. One study evaluating post-procedure calls in Mohs patients on the day of their surgery showed high satisfaction scores in nearly all patients, including patients who had previously undergone the procedure, and allowed for further discussion of expectations and concerns [118]. These findings

suggest that clinicians would benefit from anticipating and identifying covert postoperative anxieties to effectively provide lasting patient-centered care.

Patient Education

It is relatively well documented in multiple review articles and dermatologic randomized controlled trials that sufficient patient preparation in the pre-operative setting through education and consent may improve post-surgical outcomes and adherence [119-124]. Pre-operative education about pain, procedures, and equipment used may help mitigate pain for high-risk patients and improve attitudes towards postsurgical pain [28]. Additionally, successful education increases overall patient satisfaction [125].

Owing to the wide spectrum of educational levels and health literacy among patients, educational strategies may need to be customized to each individual patient. Hong et al. [20] draw attention to the importance of individualizing education by asking patients their preferred language and preferred educational method, determining their health beliefs regarding their condition and treatments, assessing baseline understanding, and eliciting the needs and goals of each patient. Furthermore, the authors suggest techniques, such as providing clear and memorable explanations by using simple words, providing rationale, limiting key concepts, grouping and repeating information, using analogies, and utilizing the "teach back" method to enhance patient-centered education. As shown in a Mohs surgery cohort study (N=85), patients can have a poor retention rate of pre-operative information, with an average retention rate in this study of 26.5% twenty minutes after being informed of ten possible complications [126]. This suggests that additional modalities of delivery, as opposed to simple verbal instruction, may be needed to improve learning in the informed consent process.

Handouts, visual aids, internet resources, and audiovisual media can be used as adjuncts in the instruction of patients. Communication through printed handouts and pamphlets that explain

disease processes, treatment plans, and wound care instructions have been proposed as simple methods that can improve the patient experience [17]. The importance of readability should be considered when providing supplemental materials and has been discussed in multiple dermatologic articles [127-129]. However, regardless of the modality of education, teaching should always be combined with some degree of verbal instruction, which allows the physician to adapt the material based on the response of the patient, assess literacy levels, and identify and alleviate any anxiety the patient may be experiencing [130].

Audiovisual

The use of video teaching modules has been documented in randomized controlled trials to improve patient satisfaction and comprehension and has been investigated in several dermatologic studies ([Table 1](#)). A randomized controlled trial of 45 Mohs patients receiving video modules for consent and wound care instructions supplemented by provider discussion found that comprehension scores were increased compared to the control group (91.6% versus 84%) and satisfaction was maintained, with 100% of patients in the intervention group stating that they would recommend the video to a friend undergoing Mohs surgery [121]. Although another Mohs micrographic surgery study showed no statistically significant increase in questionnaire performance ($P=0.13$) with digital media, 74% of patients preferred video delivery to provider instructions [122]. Similar results were observed in 84 participants undergoing skin biopsies [131]. Another recent study investigated patient preference in audiovisual informational video content for Mohs surgery patients and found high patient satisfaction with both traditional and narrative videos [132]. All of the patients described the videos as helpful in understanding Mohs surgery. The findings of these studies suggest high patient preference for audiovisual media in patient education with potential improvements in patient comprehension. Additional benefits noted by all authors also included increased efficiency and consistency with video modules. Standardized modules allow for the presentation of repetitive

material, which enables to physicians to maximize time and focus the patient encounter on addressing remaining questions and concerns [121, 122].

Conclusion

Efforts to improve the patient experience by decreasing pain, minimizing anxiety, and increasing communication and comprehension have well documented implications for improved outcomes in the care of surgical patients. The greater attention to assuring a positive patient experience in recent years has both intrinsic and extrinsic motivators, as the success of the dermatologic practice is increasingly interconnected to patient satisfaction ratings. Although pharmacologic approaches are a critical component of ensuring patient comfort and safety during dermatologic surgery, non-pharmacological strategies are often simple and cost-effective complementary techniques to enhance patient comfort. Indeed, small changes in practice may have the potential to strongly influence a patient's perception of care. In the dermatologic literature, strategies such as mechanoanesthesia, cold therapy, verbal distraction, audiovisual media, music, alternative needle insertion methods, and relaxation strategies, such as hypnosis and guided imagery, have been reported to benefit patients and reduce pain and anxiety. Furthermore, various communication and patient education techniques can strengthen the physician-patient relationship, reduce anxiety, improve comprehension, and increase patient satisfaction. Improved methods of communication and patient education currently have the largest body of evidence for use in dermatology, with multiple well-designed studies and literature reviews. Other approaches are currently being used in practice with limited small-scale evidence and anecdotal recommendations but more well-designed randomized controlled trials are needed to determine the degree of therapeutic benefits and implications of these alternative approaches. Yet, this comprehensive review specific to dermatologic surgical practice presents evidence-based strategies and provides a clinically useful resource to enhance the patient experience.

Potential conflicts of interest

The authors declare no conflicts of interests.

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Table 1: Strategies for enhancing the patient experience in dermatologic surgery.

Strategy	Authorship	Study Design	Findings	Level of Evidence*	GRADE**
Vibration	Li et al. [49]	RCT (n=53)	Significant reduction in pain with vibration co-administered during BTX-A injections.	IB	B
	Sharma et al. [47]	RCT (n=50)	Clinically significant reduction in pain during BTX-A injections; 86% patient preference of vibration therapy.	IB	
	Park et al. [48]	NCT (n=40)	Significant reduction in pain scores with vibration anesthesia during keloid treatment with intralesional steroid injection.	IIA	
	Gresham et al. [43]	Expert opinion	An elastomer-pad vibratory dampener offers a time-effective and cost-effective method for minimizing injection pain during dermatologic surgery.	V	
	Reed et al. [46]	Expert opinion	Mechanoanesthesia using a hand-held vibrating device is a safe and effective method to reduce the pain associated with injections of local anesthetics in dermatologic surgery.	V	
	Smith et al. [44]	Expert opinion	Vibration anesthesia has been found to be helpful in minimizing pain in patients undergoing injections of botulinum toxin type A treatment.	V	
	Stoecker et al. [133]	Expert opinion	Authors have found the Homedics Mini Massage-On-The-Go™ massager to be useful for reducing the pain of injections.	V	
Pinching	Fosko et al. [50]	RCT (n=60)	Repetitive pinching of the skin during lidocaine infiltration significantly reduced patient discomfort during administration of local anesthetic for cutaneous excision procedures.	IB	C
Cold anesthesia	Al-Qarqaz et al. [58]	Randomized crossover trial (n=40)	Cold air pretreatment effectively reduced VAS pain scores of needle injection for cutaneous procedures in 33 out of 40 patients.	IB	B
	Kontochristopoulos et al. [63]	Randomized, self-controlled trial (n=40)	70% of subjects receiving BTX-A injections for palmar hyperhidrosis report at least a 30% reduction in numeric pain scores with cryoanesthesia with dichlorotetrafluorethane spray compared to ice packs.	IC	
	Skiveren et al. [65]	Randomized, self-controlled trial (n=36)	Numeric rating scale, frozen gel pack, axillary BTX-A injections, significant reduction of 14-19% but may be of minimal clinical benefit- each patient received at least 40 injections	IC	
	Beer et al. [66]	Randomized, self-controlled trial (n=24)	Skin cooling did not significantly reduce VAS pain scores in patients receiving bilateral periorbital BTX-A injections compared to control (P=0.60)	IC	
	Alsantali et al. [62]	Randomized, self-controlled trial (n=23)	Ice resulted in a 40-50% reduction in VAS pain scores when compared to EMLA premedication in patients receiving BTX-A injections for palmar hyperhidrosis	IC	
	Hughes et al. [55]	NCT (n=23)	Cold air did not significantly reduce subjective pain in BTX-A injections. A significant number of patients preferred topical lidocaine plus cold air in hyaluronic acid injections.	IIA	
	Kuwahara et al. [60]	NCT (n=20)	Ice significantly decreased the discomfort associated with needle injection in dermatologic surgery. Although not as effective as EMLA, ice is easier to use, fast acting, and is less expensive than EMLA.	IIA	
	Henning et al. [56]	NCT (n=10)	Zimmer Cooling device to is an effective adjunct in reducing the pain of local anesthesia during dermatologic surgery in the pediatric population.	IIA	

	Baumann et al. [64]	Case report (n=1)	Subjectively reported a 75% decrease in pain with cryoanalgesia with dichlorotetrafluorethane for BTX-A injections in palmar hyperhidrosis	V	
	Smith et al. [61]	Expert opinion	Describes techniques for anecdotally successful interventions with ice to minimize pain with BTX-A injections for hyperhidrosis.	V	
	Haas et al. [134]	Expert opinion	Cooling gel is a useful adjunct for laser resurfacing procedures with increased patient comfort and less postprocedural epidermal tissue trauma.	V	
Verbal distraction	Zilinsky et al. [38]	Expert opinion	Verbal distraction is a recommended technique to reduce pain of needle insertion in dermatologic surgery.	V	D
	Baibergenova et al. [19]	Expert opinion		V	
Music	Alam et al. [74]	RCT (n=155)	No significant differences in subjects' pain, anxiety, blood pressure, and pulse rate across groups. In the recorded guided imagery and the relaxing music group surgeon anxiety was significantly lower.	IB	C
	Vachiramonn et al. [5]	RCT (n=100)	Anxiety levels were significantly lower in patients who listened to the music, compared to patients in the control group. More significant difference in anxiety in patients who were undergoing MMS for the first time.	IB	
	Persichetti et al. [73]	NCT (n=8)	7 of 8 patients undergoing Mohs surgery indicated a preference for listening to personally selected music through a headset.	IIA	
	Shenefelt et al. [3]	Expert opinion	Personalized music enhances patient perception of the Mohs surgery experience.	V	
Needle insertion method	Zelickson et al. [87]	Single-blinded RCT (n=318)	Significantly decreased VAS pain scores of lidocaine injection with minimal insertion technique on face and scalp with 33-gauge needle compared to 30-gauge needle.	IB	C
	Martires et al. [85]	Randomized, controlled crossover trial (n=65)	Statistically significant lower VAS pain with needle insertion at 90 degrees when compared to 45 degrees.	IB	
	Zelickson et al. [86]	Case series (n=146)	Parallel minimal insertion technique for lidocaine injection suggested as superior injection method with mean VAS pain scores of <1/10.	IV	
Hypnosis	Shenefelt et al. [67]	RCT (n=39)	Significantly reduced anxiety in the live-induction group compared to control, with no significant reduction in the recorded-induction group.	IB	C
	Shenefelt et al. [93]	Literature review	Review of applications of hypnosis in various dermatologic conditions in various small-scale and descriptive studies.	IIIA	
	Shenefelt et al. [95]	Case study (n=1)	Patient with uncontrolled anxiety was induced into trance state through hypnosis, and experienced relaxation and pleasant mental condition throughout remainder of procedure.	V	
Guided imagery	Alam et al. [74]	RCT (n=155)	No significant differences in subjects' pain, anxiety, blood pressure, and pulse rate between guided imagery and control.	IB	C
	Shenefelt et al. [95]	Case study (n=1)	Self-guided imagery may be useful in selected situations to alleviate anxiety and discomfort associated with dermatologic procedures.	V	

Communication	Nguyen et al. [105]	CME literature review	Provides practical and evidence-based suggestions for improving communication and doctor-physician relationship.	IA	A
	Golda et al. [17]	Literature review	Discusses strategies for improved patient-centered communication, as well as timing and access to care.	IA	
	Sobanko et al. [114]	RCT (n=104)	No significant change in anxiety or satisfaction with preoperative phone calls in patients undergoing same-day consultation for MMS.	IB	
	Hafiji et al. [118]	Controlled survey (n=241)	High-rated patient satisfaction with telephone follow-up (TFU) service following MMS in 95% of patients. 90% preferred calls on night of surgery. All repeat MMS patients found TFU equally useful.	IIIb	
	Renzi et al. [103]	Patient survey (n=396)	Complete overall patient satisfaction strongly correlated to a physician's ability to give explanations and demonstrate concern for the patient's health.	IV	
	Poulos et al. [106]	Patient survey (n=394)	Lowest rated care benchmarks were perceived time spent with physician, follow up of problems, expectations of treatment success.	IV	
	Fulchiero et al. [116]	Expert opinion	Strategies for improved intraoperative communication; sample hand signals are discussed to minimize technical-based verbal communication that may provoke anxiety.	V	
	Sorenson et al. [18]	Expert opinion	Describes various practical techniques to improve communication and patient education.	V	
Patient education	Hong et al. [20]	CME literature review	Provides practical suggestions for improving patient-centered education.	IA	A
	Zirwas et al. [125]	Literature review	Patient education increases satisfaction and can lead to improved outcomes and adherence. Challenges to patient education are discussed.	IA	
	Zirwas et al. [130]	Literature review	Presents evidence educational techniques, with discussion on strengths and limitations.	IA	
	Newsom et al. [132]	RCT (n=120)	High patient satisfaction with MMS informational video, with no significant difference between narrative and traditional formats.	IB	
	Armstrong et al. [131]	RCT (n=84)	There was a significant increase in knowledge score following video education, but not following oral education. However, between- group comparisons did not achieve statistical significance.	IB	
	Van Acker et al. [122]	RCT (n=50)	No statistically significant increase in questionnaire performance in patients undergoing MMS. Preferred to verbal instructions by 74% of patients.	IB	
	Migden et al. [121]	RCT (n=45)	HD video modules increased patient comprehension, efficiency, and maintained patient satisfaction in MMS.	IB	
	Burk et al. [68]	Expert opinion	Portable devices are effective in pediatric dermatologic surgery with patient preference to favorite game or movie.	V	
Follow-up visits	Sharon et al. [117]	Retrospective cohort (n=97)	Nearly 89% of the participants in the study felt that surgical follow-up was important, and 80% of the patients that desired surgical follow-up preferred to return within 3 months, with 55% opting for follow-up within 1 month.	IIB	C
Scheduling	Sharon et al. [113]	Survey (n=100)	67% (n = 65) of the surveyed population favored same-day preoperative consultation, 33% (n = 32) preferred separate-day preoperative consultation	IV	D

* Based on the Centre for Evidence-Based Medicine, Oxford (1a-5): 1a) systematic reviews (with homogeneity) of randomized controlled trials,

1b) individual randomized controlled trials (with narrow confidence interval), 1c) all or none randomized controlled trials, 2a) systematic reviews (with homogeneity) of cohort studies, 2b) individual cohort study or low quality randomized controlled trials, 2c) "outcomes" research; ecological studies, 3a) systematic review (with homogeneity) of case-control studies, 3b) individual case-control study, 4) case-series and poor quality cohort and case-control studies, 5) expert opinion without explicit critical appraisal.

**** GRADE: Grading of Recommendations Assessment, Development and Evaluation (A,B,C,D):** A) high quality of evidence, further research is very unlikely to change our confidence in the estimate of effect; B) moderate quality of evidence, further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate; C) low quality evidence, further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate; D) very low quality evidence, any estimate of effect is very uncertain.