



Distraction as a simple and effective method to reduce pain during local anesthesia: A randomized controlled trial

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KEYWORDS

Distraction;
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Summary Background: The administration of local anesthetics is considered the most unpleasant part of office-based surgery. Many procedural and pharmacological strategies have been developed to minimize pain. In children and adolescents, distraction has been demonstrated to be an effective way of minimizing pain during local anesthesia. We present a randomized controlled trial of the effect of distraction on pain during local anesthesia in adults.

Material and Methods: We have included 115 patients undergoing small office-based surgery to either the face, wrist, or hand. We randomized these patients between two groups: a control group and an intervention group. The intervention group watched a distractive video during the administration of the local anesthetic; for the rest the surgical procedures were performed in an equal fashion in both groups. Preoperative anxiety was scored from 0 to 10 and pain experienced during the injection of local anesthetic was measured on the visual analogue scale of pain (VAS), ranging from 0 to 10. Patient satisfaction was measured on the Patient Satisfaction Questionnaire (PSQ-18), ranging from 18 to 90.

Results: Patients had an equal anticipated pain score in control and intervention group. In the intervention group, a reduction of pain scores of 1 point was observed ($p = 0.01$). There was no difference in patient satisfaction scores between both groups.

Discussion: In this study, we demonstrate the pain minimizing effect of distraction during the administration of local anesthesia. Less experienced pain did not result in improved patient satisfaction in our study. We encourage physicians to seek ways to actively distract patients during unpleasant procedures.

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Introduction

The injection of local anesthetics is considered the most painful and unpleasant part of office-based surgery.¹ The injection solution (mostly lidocaine) gives a sharp burning

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sensation that is mostly due to its pH level and the volume expansion at the injection site.² Much research has already been done on improving the administration of local anesthetics to minimize pain. It is, for example, demonstrated that warming the injection solution, reducing the diameter of the needle, buffering the solution with sodium bicarbonate, and using a perpendicular injection can reduce pain.¹ Nonetheless, patients remain anxious for local anesthesia, which can even lead to negligence of medical care.³

Sedation to lower stress and minimize pain during injection has been studied with good effect but it requires more premedication and needs to be done in a more controlled setting.^{4,5} A more practical and easy way to reduce stress and anxiety during medical procedures is by distraction. The latter is mostly investigated in children and adolescents. In a recent review, video distraction, for example, was shown to be effective to reduce pain and anxiety in children.⁶ Also, more simple distraction as letting children write words in the air with their legs during injection was demonstrated to significantly reduce pain without the need of sedation.⁷

To our knowledge, in adults, simple distraction to reduce pain during local anesthesia has never been well studied. In this study, we have addressed the effect of a simple distraction method on pain during the administration of local anesthesia. We furthermore investigate whether distraction and the hypothesized reduction in pain could also improve patient satisfaction.

Materials and methods

Ethical considerations

Before conducting the study, written permission from the local department of the medical ethical committee as well as from the board of directors of our hospital was obtained. Informed consent forms were used to inform all eligible patients about the purpose and plan of the study and how data of the study would be used and stored.

Sample

From June 2018 until November 2018, we approached all patients that presented for office-based surgery at our plastic surgery department. Patients undergoing either facial skin surgery or hand surgery were eligible for inclusion. Facial surgery patients were operated on small skin lesions (e.g., naevi or various forms of skin cancer (basal cell carcinoma or squamous cell carcinoma) on cheeks, forehead, paranasal, temporal, or perioral. All lesions had a comparable diameter. The wound could be closed either primarily or with a minor local transposition flap. Hand surgery patients consisted of patients undergoing either trigger finger release, carpal tunnel release, or removal of small skin lesions on hands or wrist. Exclusion criteria in this study were eyelid or near eye surgery, a known allergy to the local anesthesia, visual impairment, and a known peripheral neuropathy. Also, patients that would undergo a peripheral nerve block were excluded from this study.

Patients eligible for inclusion were asked written informed consent previous to participate in this study. First,

from all included patients, demographic factors (sex, age, education level, and marital status) were obtained. Second, the operating surgeon and the anatomic location of the surgery (hand surgery or facial skin surgery (e.g., dermatologic or oncologic surgery) were noted.

Procedure

Patients that were eligible for inclusion were first divided into hand surgery patients and patients undergoing facial skin surgery. Within before mentioned groups, patients were randomized (stratified randomization) in a control group and an intervention group by a computer-generated sequence.

Control group

Patients in the control group were administered local anesthesia as in standard of care at our department. In our hospital, a combination of the local anesthesia of choice is a combination of lidocaine and adrenaline in a ratio of 1:80,000 (concentrations of 20 mg/ml lidocaine and 12.5 microgram/ml adrenaline). In this study, the local anesthetic was warmed to body temperature, and for generalization purposes was not buffered with sodium bicarbonate. Furthermore, a needle with the smallest possible gauge was used for injection: 27 gauge for local anesthetic in the face and 23 gauge for local anesthetic in the hand or wrist region. Depending on the size of the injection site, the amount of local anesthesia varied from 2 cc to a maximum of 5 cc. The local anesthetic was injected in a slow constant rate to ensure not to over inject the injection site. Injection was always in the subcutaneous tissue directly at or surrounding the operated tissue.

After surgery, patients were referred to a specially instructed nurse for after care. Here, patients reported a pre-operative anxiety level on the visual analogue of pain scale (VAS) from 0 to 10 (0 meaning to have had no anxiety before the local anesthesia and 10 being worst anxiety possible). Consequently, patients reported the amount of pain they experienced during local anesthesia on the VAS scale (0 being no pain and 10 being the worst pain possible). Lastly, patients filled out the Patient Satisfaction Questionnaire Short version with 18 questions (PSQ-18) to assess patient satisfaction after treatment (scores ranging from 18 to 90 with higher scores indicating better satisfaction). The PSQ-18 is a thoroughly tested and validated questionnaire that correlates well with general satisfaction of medical care.^{8,9}

Intervention group

Patients randomized for the intervention group were treated equal to the control group but were distracted during administration of local anesthesia by watching a short video. The administration of the local anesthesia was performed according to the same standards as previously prescribed in the control group.

The distraction video was started at least 15 s before the beginning of the administration of the anesthetic.

Table 1 Patient Characteristics ($n = 115$).

	All patients ($n = 115$) mean (SD)	Control ($n = 58$) mean (SD)	Intervention ($n = 57$) mean (SD)	<i>p</i> -value
Characteristic				
Age, years	58.2 (18.9)	58.6 (19.5)	57.8 (18.6)	0.95
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>p</i> -value
Sex				
Male	46 (40)	21 (36)	25 (44)	0.40
Female	69 (60)	37 (64)	32 (56)	
Marital status				
Single	31 (27)	15 (26)	16 (28)	0.47
In a relationship	16 (14)	11 (19)	5 ^a	
Married	56 (49)	26 (45)	30 (53)	
Widowed	12 (10)	6 (10)	6 (11)	
Education				
High school	43 (37)	26 (45)	17 (30)	0.31
College graduate	34 (30)	17 (29)	17 (30)	
Academic graduate	38 (33)	15 (26)	23 (40)	
Type of surgery				
Facial surgery	65 (43)	24 (42)	26 (46)	0.65
Hand surgery	65 (57)	34 (58)	31 (54)	
Operating surgeon				
Surgeon A	22 (19)	13 (22)	9 (16)	0.83
Surgeon B	43 (37)	21 (36)	22 (39)	
Surgeon C	32 (28)	15 (26)	17 (30)	
Surgeon D	18 (16)	9 (16)	9 (16)	

The first section of the video showed the a 1 min and 20 s “shell game” (https://youtu.be/_bnnmWYI0IM). In this video, three cups and one small ball are placed in the middle of a table. The ball is placed under one of the cups and the cups are randomly shuffled. After watching the video (and therefore after injection of local anesthesia), patients were asked where the ball was located. After this, the rest of the procedure was performed as usual.

Both patients in the intervention group as those in the control group were asked to fill out the same questions and questionnaires. Patient demographics, operating surgeon, type of surgery, and the answers given in the questionnaires were then put in digital research software Castor, which automatically generates a research database.

Data analysis

Licensed Stata 14 for Mac (StataCorp. 2017. Stata Statistical Software: Release 14. College Station, TX: StataCorp LLC) was used to assess the data. Criteria were defined with standard deviation, mean, frequency, and percentage values. Chi-square test was used for the comparison of frequency and percentages of between-groups, and for independent groups, one-way analysis of variance was used. Normality of the data was assessed with the Shapiro-Wilk test. The Mann-Whitney U test was used for variables that were non-normally distributed. Significance was assessed at the level of $p < 0.05$.

Results

Characteristics

In total, 115 patients were included in this study with a mean age of 58 years (range 16-95). Of the patients included, there were 46 men (40%) and 69 women (60%). Of the patients, 65 (57%) had facial surgery and 50 patients (43%) had hand or wrist surgery. Patients were equally distributed among the control group (58 patients) and the intervention group (57 patients).

When patients in the control and intervention group were compared based on age, sex, marital status, educational level, and type of surgery, no statistical significant differences were found (Table 1).

When comparing patients between different types of surgery, patients were equally distributed between the control group and intervention group. Furthermore, no differences were found in terms of sex, age, marital status, and education level (Table 2). Lastly, all four surgeons operated an equal amount of patients in the control and intervention groups (Table 2).

Preoperative anxiety scores

Patients in both groups reported equal scores when asked for preoperative anxiety regarding the administration of the local anesthesia. Scores ranged from 0 to 10 in both the control and intervention group. When looking at both hand surgery and facial surgery patients combined, the mean anxiety VAS in the control group was 4.0 ± 3.0 vs. 3.8 ± 2.9 in the intervention group ($p = 0.36$). When specified between

Table 2 Characteristics per group specified by anatomical location.

Characteristic	Facial Surgery (n = 65)			Hand surgery (n = 50)		
	Control (n = 33) mean (SD) n (%)	Intervention (n = 31) mean (SD) n (%)	p-value	Control (n = 24) mean (SD) n (%)	Intervention (n = 26) mean (SD) n (%)	p-value
Age, years	55.6 (22.8)	57.4 (20.8)	0.80	62.8 (12.7)	58.3 (16.0)	0.50
Sex						
Male	13 (38)	13 (42)	0.76	8 (33)	12 (46)	0.34
Female	21 (62)	18 (58)		16 (67)	14 (54)	
Marital status						
Single	11 (32)	8 (26)	0.17	4 (17)	8 (30)	0.52
In a relationship	8 (24)	2 ⁶	3 (13)	3 (11)		
Married	12 (35)	16 (52)		14 (58)	14 (54)	
Widowed	3 ⁹	5 (16)		3 (13)	1 ⁴	
Education						
High school	15 (44)	11 (35)	0.37	11 (46)	6 (23)	0.39
College graduate	11 (32)	7 (23)	6 (25)	10 (38)		
Academic graduate	8 (24)	13 (42)	7 (29)	10 (38)		
Operating surgeon						
Surgeon A	13 (38)	9 (29)	0.43	0	0	0.83
Surgeon B	21 (62)	22 (71)		0	0	
Surgeon C	0	0		15 (63)	17 (65)	
Surgeon D	0	0		9 (38)	9 (35)	

Table 3 Outcome scores.

Outcome	All patients (n = 115)			Facial surgery (n = 65)			Hand surgery (n = 50)		
	Control (n = 58) Mean (SD)	Intervention (n = 57) Mean (SD)	p-value	Control (n = 34) Mean (SD)	Intervention (n = 31) Mean (SD)	p-value	Control (n = 24) Mean (SD)	Intervention (n = 26) Mean (SD)	p-value
Anticipation (0-10)	4.0 (3.0)	3.8 (2.9)	0.36	3.5 (3.0)	3.5 (3.0)	0.51	4.8 (2.9)	4.2 (2.8)	0.49
VAS score (0-10)	4.5 (2.6)	3.4 (2.6)	0.01	4.3 (2.8)	3.2 (2.8)	0.05	4.9 (2.3)	3.7 (2.3)	0.07
PSQ score (18-99)	69.7 (9.9)	70.3 (10.5)	0.61	69.6 (11.0)	69.9 (9.6)	0.54	69.9 (8.3)	70.1 (11.7)	0.61

types of surgery, this same outcome was observed with a mean anxiety VAS of 3.5 ± 3.0 for controls vs. 3.5 ± 3.0 for interventions in patients undergoing facial surgery and 4.8 ± 2.9 for controls vs. 4.2 ± 2.8 for interventions for patients undergoing hand surgery (Table 3).

Pain scores

Patients reported lower pain scores in the intervention group compared to the control group (Figure 1). Patients in the control group had a mean VAS pain score of 4.5 ± 2.6 compared to 3.4 ± 2.6 in the control group ($p=0.01$; Table 3; Figure 1).

When specifying for facial surgery and hand surgery, a comparable reduction of pain was observed in both sub groups. Patients that underwent surgery to the face had a mean pain score of 4.3 ± 2.8 in the control group compared to 3.2 ± 2.8 for patients that were distracted ($p=0.05$; Figure 2). For patients undergoing surgery to the wrist or hand, the mean pain score was 4.9 ± 2.3 for the control group and 3.7 ± 2.3 for the intervention group ($p=0.07$; Figure 2).

Patient satisfaction scores

Patient satisfaction scores (expressed in PSQ-18 scores) were equal among patients in the control group and in the intervention group (69.7 ± 9.9 vs. 70.3 ± 10.5 , $p=0.61$) (Table 3).

PSQ-18 scores were also similar between controls and interventions when differentiating between facial surgery (69.6 ± 11.0 vs. 69.9 ± 9.6 , $p=0.54$) and hand and wrist surgery (69.9 ± 8.3 vs. 70.1 ± 11.7 ; $p=0.61$) (Table 3).

Discussion

Pain control is one of the most important aspects in administration of local anesthetics during office-based surgery. Many pharmacological and procedural strategies have been developed to reduce pain in patients undergoing local anesthesia.

This study was performed to investigate whether simple distraction during the actual moment of administration of the local anesthetic could lead to a reduction of pain.

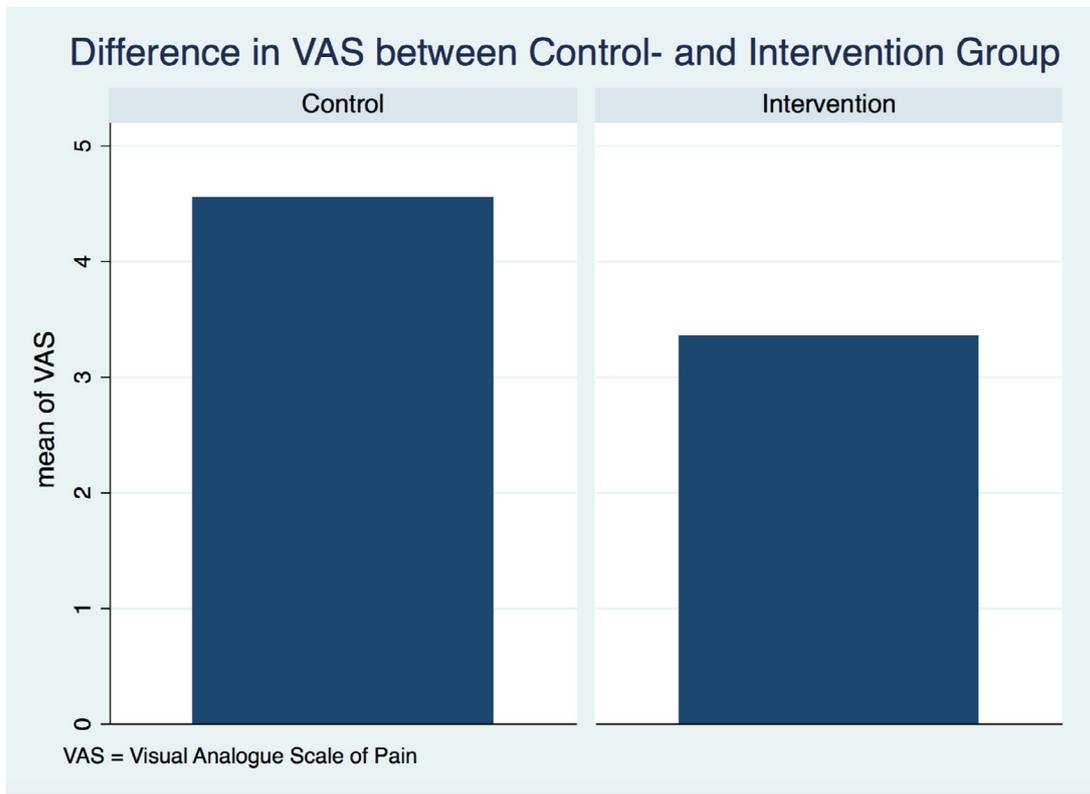


Figure 1 Pain scores overall patients.

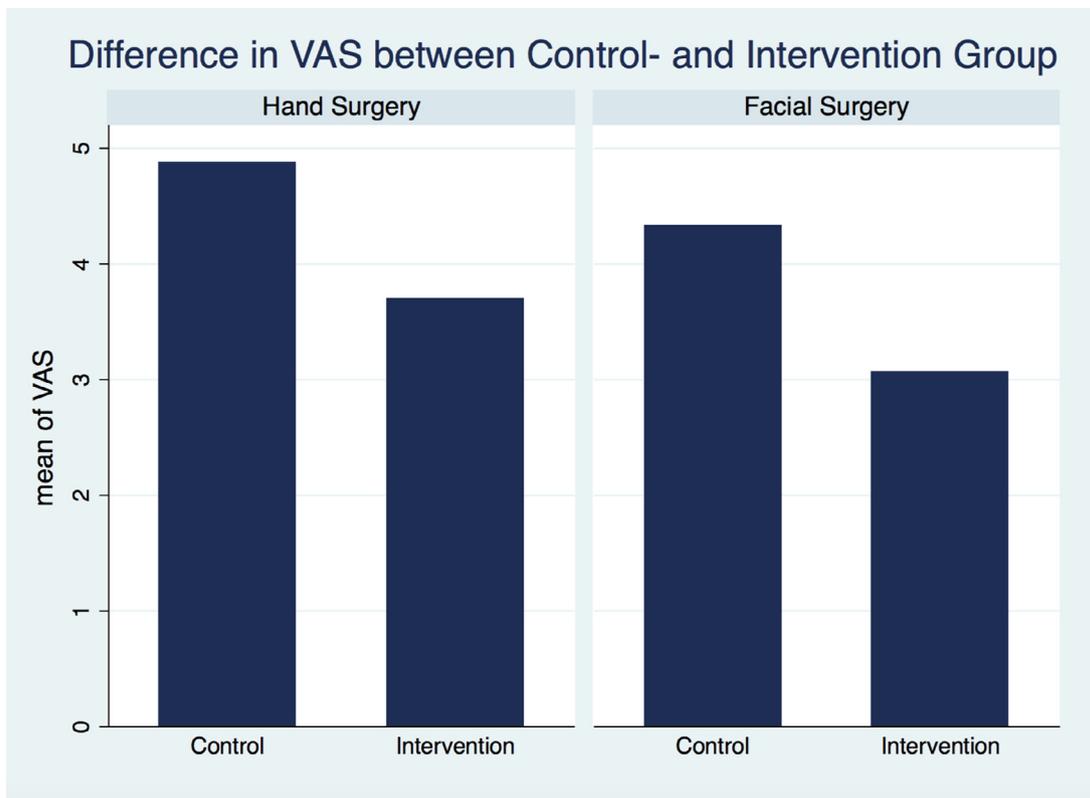


Figure 2 Pain scores specified between hand- and facial surgery patients.

Patients included in this study reported significantly lower pain scores when distracted, with a mean decrease of VAS scores of 1.1 point. The clinical relevance and impact of a 1-point reduction of pain in the VAS score is unclear, but, nonetheless, a significant reduction is demonstrated.

Patient satisfaction was not different in control patients and intervention patients. This could either mean that a small reduction of pain is not enough to improve patient satisfaction or that the PSQ-18 is not the right tool to investigate satisfaction in our specific population. The PSQ-18 is a general questionnaire about patient satisfaction and contains several questions, for example, about affordability and accessibility of care. This makes the PSQ-18 only moderately applicable to our research question because a large proportion of the score is based on outcomes of parameters not influenced by our intervention. This suggests that the PSQ-18 might not be sensitive enough to demonstrate small differences in satisfaction after a procedure.

This study outcomes should be interpreted in the light of the following limitations:

First, the surgical procedures that patients underwent were not equal among patients and subgroups. We deliberately chose to include patients with comparable but not identical procedures in this study for generalization purposes. By analyzing both facial surgery and hand surgery patients together, we hoped to demonstrate a general pain-reducing effect of distraction, which could be extrapolated more easily. We understand other author's preference to perform this study in one specific procedure for better statistical power.

Second, procedures, distraction, and administration of the local anesthetic was performed in a standardized fashion by 1 of 4 surgeons, but could not be blinded. Therefore, both patients and physicians were aware of the fact that the patient was allocated either to the intervention or the control group.

Thirdly, patients were given an informed consent letter preoperatively, in which the general purpose of the study was also explained (as required by law). Patients, therefore, knew beforehand that they would either receive standard of care or undergo injection in combination with the distraction movie. A placebo effect of just being in the intervention group is, therefore, plausible. A sort of opposite-placebo effect in the control group is also imaginable; if patients did not watch the movie for distraction, an increased awareness of pain could have led to higher pain scores.

Indeed, some patients told us that they were more anxious and expected more pain just because of reading the information letter. A subset of patients also expressed disappointment when they found out that they were allocated to the control group because they hoped to "have less pain because of the distraction."

This is, nonetheless, not demonstrated by the anticipation scores patients filled out after the procedure, as they were equal among both control and intervention patients.

Conclusion

Simple distraction by means of showing patients a distracting movie can significantly reduce pain during local anesthesia. When sub-analyzing patients undergoing small office-based surgery, an equal reduction of VAS scores was demonstrated among patients undergoing facial surgery and hand or wrist surgery. Even though statistical significance was not reached in patients undergoing hand surgery, a clear similar trend was observed in this subset of patients as well.

Even though patients reported to have experienced less pain, patient satisfaction was not affected in our intervention group.

Distraction has been demonstrated to be an effective measure to reduce pain from injections and procedures in children. This study shows a similar effect in adults. Even though a placebo effect is likely, this should not be of much importance for the interpretation and application of our outcomes.

Even if the results are mostly explained by a placebo effect, there is still a noticeable and significant pain-reducing effect of our intervention. We, therefore, advise healthcare workers to find and use suitable ways of distraction when performing painful procedures on patients. In our study, a short movie was used and proven effective. Other distraction techniques such as small talks or playing music during local anesthesia may also be equally effective. We, therefore, encourage healthcare workers to find suitable ways to distract patients during unpleasant procedures.

Declaration of Competing Interest

None.

Funding

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References

1. Strazar AR, Leynes PG, Lalonde DH. Minimizing the pain of local anesthesia injection. *Plast Reconstr Surg* 2013;132(3):675-84. doi:10.1097/PRS.0b013e31829ad1e2.
2. Morris RW, Whish DKM. A controlled trial of pain on skin infiltration with local anaesthetics. *Anaesth Intensive Care* 1984;12(2):113-14.
3. Milgrom P, Coldwell SE, Getz T, Weinstein P, Ramsay DS. Four dimensions of fear of dental injections. *J Am Dent Assoc* 1997;128(6):756-62. doi:10.14219/jada.archive.1997.0301.
4. Mutalik S. How to make local anesthesia less painful. *J Cutan Aesthet Surg* 2008;1(1):37-8. doi:10.4103/0974-2077.41161.
5. Rozanski M, Neuhaus V, Reddy R, Jupiter JB, Rathmell JP, Ring DC. An open-label comparison of local anesthesia with or without sedation for minor hand surgery. *Hand* 2014;9(4):399-405. doi:10.1007/s11552-014-9670-6.
6. Dwairej D, Obeidat H, Khalaf I. The effectiveness of video distraction on children preoperative anxiety: an integrative literature review. *Open J Nurs* 2018;8(3):171-87. doi:10.4236/ojn.2018.83015.7.

7. Uman LS, Chambers CT, McGrath PJ, Kisely S. A systematic review of randomized controlled trials examining psychological interventions for needle-related procedural pain and distress in children and adolescents: an abbreviated cochrane review. *J Pediatr Psychol* 2008;**33**(8):842-54. doi:[10.1093/jpepsy/jsn031](https://doi.org/10.1093/jpepsy/jsn031).
8. Marshall GN, Hays RD. The patient satisfaction questionnaire short form (PSQ-18). *Rand* 1994:1-36. doi:[10.1111/j.1525-1497.2004.30059.x](https://doi.org/10.1111/j.1525-1497.2004.30059.x).
9. Thayaparan AJ, Mahdi E. The patient satisfaction questionnaire short form (PSQ-18) as an adaptable, reliable, and validated tool for use in various settings. *Med Educ Online* 2013;**18**(1). doi:[10.3402/meo.v18i0.21747](https://doi.org/10.3402/meo.v18i0.21747).