

The Impact of Camouflage Syringes in Reducing Injection Pain in the Dental Clinic among Pediatric Patients. A Randomized Clinical Trial

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Abstract:

Aim of the study: The present study aimed to evaluate the effectiveness of using a Camouflage syringe in reducing dental pain in children at the dental clinic compared to the conventional one.

Materials and Methods: A sample size was 70 children was referred to the Department of Pediatric Dentistry at Damascus University, aged 6-9 years, in need of dental treatment in the maxillary region that requires local anesthesia. The sample was randomly divided into two parallel groups, with 35 patients in each group as follows: Group 1 received the injection using a Conventional syringe with the Tell-Show-Do technique, and Group 2 received the injection using a Camouflage syringe with the Tell-Show-Do technique. The level of pain

in children was assessed using: Wong-Baker FACES Scale modified by Al Monaquel and Hajji-baker.

Results: The results showed a decrease in dental pain levels in the camouflage syringe group compared to the conventional syringe group, with statistically significant differences between the two groups. However, no significant differences were reported between males and females, whether in the total sample size or within the studied groups.

Conclusions: Based on the current study, the use of a Camouflage syringe can reduce dental pain in children aged 6-9 years when receiving local anesthesia injections in the maxillary region.

Key Words: Dental pain, Dental Anxiety, local anesthesia, the camouflage syringe, the conventional syringe.

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تأثير المحقنة المموّهة في تقليل ألم الحقن في العيادة السنية لدى المرضى الأطفال

دراسة سريرية معشاة

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الملخص:

هدف الدراسة: هدفت هذه الدراسة إلى تقييم فعالية استخدام المحقنة المموّهة في تقليل الألم

السني لدى الأطفال في العيادة السنية، مقارنةً بالمحقنة التقليدية.

المواد والطرق: تكوّنت العينة من 70 طفلاً تمت إحالتهم إلى قسم طب أسنان الأطفال في

جامعة دمشق، وتتراوح أعمارهم بين 6-9 سنوات، ويحتاجون إلى علاج سني في منطقة

الفك العلوي يتطلب تخديراً موضعياً. تم تقسيم العينة عشوائياً إلى مجموعتين متوازيتين،

تضم كل مجموعة 35 طفلاً، كما يلي:

المجموعة الأولى: تلقى الأطفال الحقنة باستخدام المحقنة التقليدية مع تطبيق تقنية "أخبر-

أري-أفعل".

المجموعة الثانية: تلقى الأطفال الحقنة باستخدام المحقنة المموّهة مع تطبيق تقنية "أخبر-

أري-أفعل" تم تقييم مستوى الألم لدى الأطفال باستخدام مقياس Wong-Baker الذاتي

لتقييم الألم والمعدل. من قبل المنقل.

النتائج: أظهرت النتائج انخفاضاً في مستويات الألم السني في مجموعة المحقنة المموّهة

مقارنةً بمجموعة المحقنة التقليدية، مع وجود فروقات ذات دلالة إحصائية بين المجموعتين.

ومع ذلك، لم تُسجّل فروقات ذات دلالة إحصائية بين الذكور والإناث سواء ضمن العينة

الكلية أو ضمن مجموعات الدراسة.

الاستنتاجات: بناءً على نتائج هذه الدراسة، يمكن لاستخدام المحقنة المموّهة أن يقلل من ألم

الحقن لدى الأطفال الذين تتراوح أعمارهم بين 6-9 سنوات عند تلقيهم للتخدير الموضعي

في منطقة الفك العلوي.

الكلمات المفتاحية: الألم السني، القلق السني، التخدير الموضعي، المحقنة المموّهة،

المحقنة التقليدية.

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سورية، يحتفظ المؤلفون بحقوق

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Introduction:

Pain is an unpleasant sensory and distressing emotional experience associated with actual or potential tissue damage (1). It is considered a personal and individual sensation, and each one expresses it in their way, depending on previous painful experiences, especially those caused by injuries during early childhood. In addition, when treating children, undesirable physical and psychological factors related to the pain must be taken into consideration (2).

The most common complaints in dental clinics are acute and chronic pain. They can notably affect the quality of life for the patients (3).

Anxiety is a psychological state that occurs before the person interacts with a threatening or stressful situation, even if the situation does not exist. It is considered a common personality experience and a temporary emotional feeling in daily life (e.g., before exams or when making important work decisions) (4). This psychological condition is very common, with a global prevalence of 25.8% (5).

According to Van Wijk and Hoogstraten's study, dental pain and anxiety are two faces of the same coin since Anxious patients often feel pain more intensely and for longer durations than those who are less anxious (6).

Pharmacological and non-pharmacological approaches play a critical role in managing dental anxiety in children. While drugs like hydroxyzine and midazolam are effective, behavioural techniques such as Tell-Show-Do, modeling, and distraction are safer and equally effective. Non-pharmacological approaches are often preferred due to fewer side effects and better acceptance by children and parents (7).

Local anesthesia is the temporary loss of sensation in a specific area of the body, achieved by inhibiting nerve signal transmission or decreasing neural activity at the nerve endings in the targeted region (8). During dental clinic, this procedure is considered a significant challenge, particularly in Pediatric patients, because the sight of the needle and syringe causes psychological trauma to the child

and thus impedes the effective behavioural control (9, 10).

However, several techniques were improved to avoid exposing the child to the appearance of the needle, such as audio-visual distraction (11), or disguising dental instruments like the syringe (12). According to Sathyaprasad et al study, adding colors or cartoon characters to the syringe has shown a

positive impact on children's behavior, increases comfort, and helps reduce dental anxiety and pain (12).

Solanki et al (13) concluded that using a camouflage dental syringe gave better results than a conventional syringe in reducing dental pain and anxiety and increasing patients' acceptance of dental injections among children aged 6-11 years.

Limited studies were found that have been conducted to investigate the effectiveness of alligator-shaped sleeves in the management of pain and improving behavioral attitude among children during the administration of local anesthesia (14, 15).

Therefore, the current study aimed to evaluate the camouflaged syringe in reducing pain according to the Wong-Baker FACES Pain Rating Scale, modified by Al-Monaqel and Al-Hajji Bakr, compared with the conventional syringe during the administration of local anesthesia in the maxillary region among Pediatric patients aged 6 to 9 years.

Materials and Methods:

Study design and Ethical approval

The current study was a double-blind randomized clinical trial with two parallel groups and was conducted at the Department of Pediatric Dentistry, Faculty of Dentistry, Damascus University, between December 2023 and May 2024.

The guideline of the CONSORT checklist (16) was followed, and the principles adopted by the Declaration of Helsinki for research involving human participants (17) were adhered to. Ethical approval was granted by the Ethical Committee of Damascus University (Approval No. 2793/2023).

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No participants were excluded based on gender, socioeconomic status, or ethnicity. Additionally, all procedures were explained to the children's parents before obtaining written informed consent.

Sample Size

Sample size calculation was performed using G*Power software version 3.1.9.4 (Heinrich Heine University, Düsseldorf, Germany). A total of 70 children was considered sufficient to detect a small effect size ($f = 0.36$), with a statistical power of 80% ($1 - \beta$) and a significance level of 0.05 (18, 19). A pilot study involving 10 children was used to estimate the effect size (20).

Eligibility criteria

Healthy children aged 6 to 9 years who required dental treatment involving infiltration anesthesia in the maxillary region were included in this study. Additionally, eligible participants had no prior dental experience, had not received any sedative or analgesic medication within the three hours before the appointment, and demonstrated positive behavior according to Frankl's Behavior Rating Scale.

Exclusion criteria were Children who could not communicate effectively or had physical or cognitive disabilities. Additional exclusion criteria included the presence of acute pulpitis or acute dental abscess, as well as refusal of consent by the child's legal guardian.

A total of 76 children referred to the Department of Pediatric Dentistry at Damascus University were initially assessed for eligibility based on the predefined inclusion and exclusion criteria. 70 children met the criteria and were enrolled in the study. They were randomly assigned to two parallel groups:

Group 1 (Control Group): Received local anesthesia using a conventional syringe ($n = 35$).

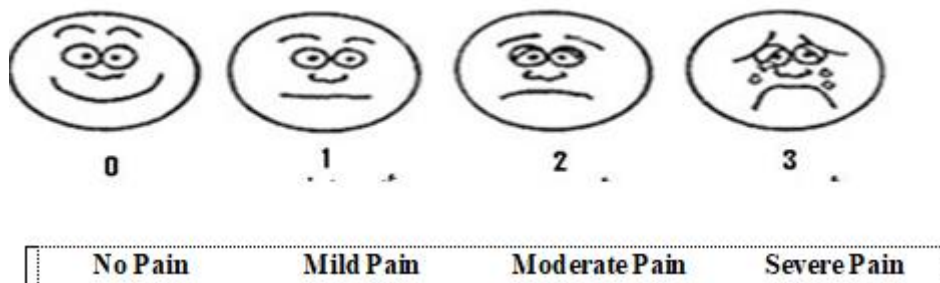
Group 2 (Experimental Group): Received local anesthesia using a camouflage syringe ($n = 35$).

Randomization and blinding: An online randomization tool (<https://www.randomizer.org>) was used to randomly allocate the Participants into two groups at a 1:1 ratio. Two sets were generated, each containing 35 children, with numbers ranging from 1 to 70. This was a double-blind trial, in which the participants and the data analyst were all blinded to group assignments. The children were unaware of their group allocation and the specific aim of the study.

Primary outcomes measure

The Wong-Baker FACES Pain Rating Scale, modified by Al-Monaquel and Al-Hajji Bakr:

This adapted version comprises four facial expressions instead of the six found in the original scale, with scores ranging from 0 (no pain) to 3 (severe pain). The reduction in the number of options aims to simplify the selection process for children, thereby enhancing the accuracy of pain assessment. A preliminary study evaluating the reliability of the modified scale demonstrated a reliability rate of 90%, which was higher than that reported for the original six-face version (21). To assess the child's perceived pain during local anesthesia, the scale was presented in printed form, and each child was asked to select the face that best reflected their pain experience. The selected score was recorded immediately following the administration of anesthesia. (Figure 1)



Fig(1): The Wong-Baker FACES Pain Rating Scale, modified by Al-Monaquel and Al-Hajji Bakr.

Procedure

An intraoral examination was conducted to confirm that participating children exhibited positive behavior, as assessed by the Frankl Behavior Rating Scale. Behavioral management was initially implemented using the Tell-Show-Do (TSD) technique to familiarize the child with the dental syringe and procedure, employing gentle, age-appropriate language. Subsequently, a 20% topical anesthetic, benzocaine, was applied to the injection site with a cotton swab for two minutes. Following group allocation through randomization, local anesthesia was administered using either a conventional or camouflage syringe, according to the participant’s assigned group. Pain perception was immediately evaluated by the examiner after anesthesia administration using the modified Wong-Baker FACES Pain Scale

Statistical analysis

IBM SPSS Statistics® version 25 (IBM Corp., New York, USA) was used to perform all statistical

analyses. Categorical variables, such as gender and responses on the modified Wong-Baker FACES Pain Scale, were summarized using frequencies and percentages. Continuous variables, including age and pain scale scores, were described using appropriate descriptive statistics. Assessing the normality of the data distribution was done using the Kolmogorov-Smirnov test was used to. The Mann-Whitney U test was employed to compare the control and experimental groups, as well as males and females. The significance level was set at 0.05.

Results:

A total of 70 children participated in this study, with 36% male and 64% female. The mean age was 7.43 ± 1.08 years. The largest proportion of children (37.1%) reported experiencing mild pain following local anesthesia in the maxillary region. An equal number of children (10) reported moderate and severe pain, based on the Wong-Baker FACES Pain Rating Scale as modified by Al-Monaquel and Al-Hajji Bakr. (Table 1 - 2)

Table (1): Frequency and percentage of categorical variables in the study.

		N	%
Gender	Male	25	~36.0
	Female	45	~64.0
Studied groups	The conventional syringe	35	50.0
	The camouflage syringe	35	50.0
The Wong-Baker FACES Pain Rating Scale, modified by Al-Monaquel and Al-Hajji Bakr.	No pain	24	34.3
	Mild pain	26	37.1
	Moderate pain	10	14.3
	Severe pain	10	14.3
N: Number of cases.			
%: Percentage.			

Table (2): Statistical indices for numeric variables in the study.

	Minimum	Maximum	Median	Mean	Std. Deviation
Age	6.00	9.00	7.00	7.34	1.08
The modified Wong-Baker FACES	0.00	3.00	1.00	1.09	1.03

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The Man-Whitney test showed that no statistically significant difference between males (Mean = 1.20) and females (Mean = 1.02) (*P-value* = 0.502), regarding the Modified Wong-Baker Faces scale when comparing genders regardless of group assignment. indicating similar pain perception between sexes. **(Table 3) (Figure 2)**

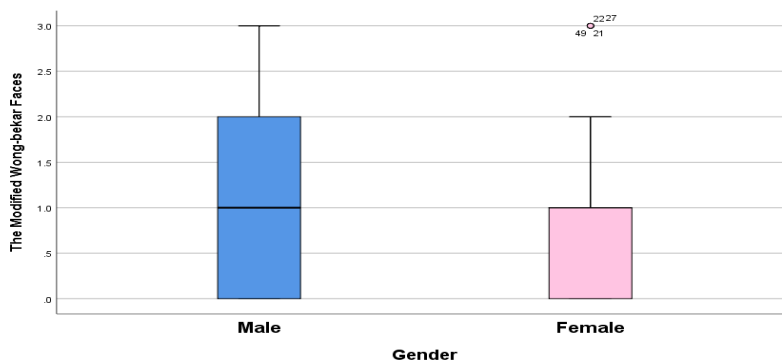
In contrast, the Man-Whitney test reported a significant difference between the two studied groups (*P-value* = 0.011). While children in Group A (conventional syringe) reported mean pain scores (Mean = 1.37), the children in Group B (camouflage syringe) reported notably lower mean pain scores

(Mean = 0.80). This means that the camouflage syringe was correlated with lower pain perception. **(Table 3) (Figure 3)**

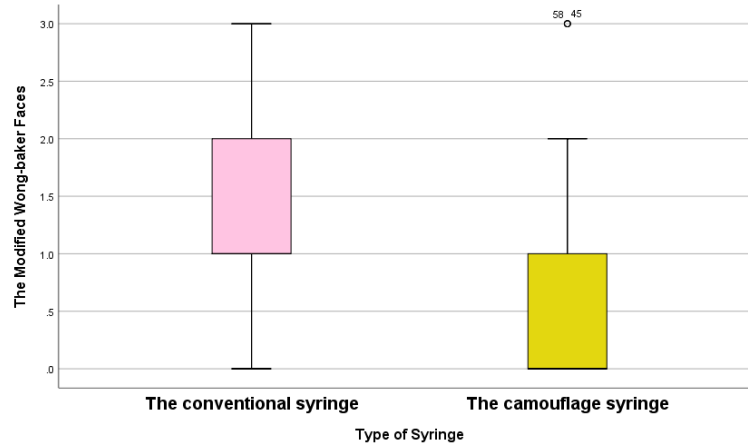
Moreover, within-group analysis by gender revealed no significant gender-based differences in pain perception within either group. Males showed higher pain scores (Mean = 1.73) than females (Mean = 1.21), but this difference was not statistically significant (*P-value* = 0.087) in Group A. The same result (no significant difference between male and female) was found in Group B, since the *P-value* = 0.742. **(Table 3)**

Table (3): Man-Whitney test to compare the gender and the studied groups according to the modified Wong-Baker FACES.				
		The modified Wong-Baker FACES		<i>P-value</i>
		Mean	Median	
Gender	Male	1.20	1.00	.502
	Female	1.02	1.00	
Studied groups	Group A	1.37	1.00	.011 *
	Group B	0.80	0.00	
Within Group A	Male	1.73	2.00	.087
	Female	1.21	1.00	
Within Group B	Male	0.79	0.00	.742
	Female	0.81	1.00	

Group A: The conventional syringe.
 Group B: The camouflage syringe.
 *: a significant difference.



Fig(2): Boxplot to show the difference between male and female according to the Wong-Baker FACES Pain Rating Scale, modified by Al-Monaquel and Al-Hajji Bakr.



Fig(3): Boxplot to show the difference between the conventional syringe and the camouflage syringe according to the Wong-Baker FACES Pain Rating Scale, modified by Al-Monaquel and Al-Hajji Bakr.

Discussion:

Dental treatments are considered painful and unpredictable for children and may be worsened by dental fear and anxiety, leading to a negative attitude against the dental clinic (12). Additionally, local anesthesia is a significant part of dental procedures to control pain; however, it is also considered a major source of dental anxiety and discomfort (22). Management of dental fear and anxiety is a major challenge for both the Pediatric dentist and the patients, especially in children, who are more sensitive to the dental environment due to their lower maturity and cognitive abilities (23). Reducing fear and anxiety associated with local anesthesia in a dental clinic is critical to achieving a successful treatment and a positive dental attitude in the future. Different behavioral management techniques were improved to minimize pain during the injection. One of those is camouflaging the syringe. So, this study was conducted to evaluate the effectiveness of a syringe camouflage technique in reducing pain during local anesthesia in the maxillary region among children aged 6 - 9 years. Generally, children aged 6 to 9 years can understand the concepts of pain and anxiety, which makes self-assessment scales more reliable (23). In addition, School-aged children also tend to show high levels of dental anxiety (5).

Dental pain after infiltration anesthesia in the maxillary region among children was assessed using the Wong-Baker FACES Pain Rating Scale, modified by Al-Monaquel and Al-Hajji Bakr. This modified scale includes only four facial expressions instead of the original six, to make the selection process easier for children and thus obtain more accurate self-assessments (21). This study showed a statistically significant difference between the two groups (the conventional syringe group and the camouflage syringe group) according to the modified Wong-Baker FACES scale. Children in the camouflaged syringe group reported lower pain scores, with a mean of 0.80, compared to a higher mean score of 1.37 in the conventional syringe group. This result can be explained by what was reported in many studies (14, 15, 24, 25), which showed that the camouflage syringe reduced the anxiety related to the sight of a needle during local anesthesia procedures. So, the reduction in pain in the camouflaged syringe group is due to lower anxiety levels compared to the conventional syringe group. A positive correlation between pain and anxiety was reported among the children in this age group in the Bchara et al study (26), and the Sanikop et al study (27) confirms this result. This could be explained by the fact that anxiety lowers the pain threshold, making patients more sensitive to painful stimuli (28).

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The findings of this study are consistent with what was shown in the Sathyaprasad et al study (12) and the Solanki et al study (13).

Moreover, the results in this study agree with what was mentioned in Bondarde, Mujawar et al study (29), who found that using a camouflaged insulin syringe led to lower dental pain levels. Their study attributed the reduction in pain to the thinner insulin needle, which resulted in a less painful experience for patients.

Female children tend to report higher levels of pain during dental injections compared to their male counterparts, according to Several studies (30, 31). However, this study found no significant difference between males and females in expressing pain during injection.

This study has several limitations. First, a single gender of a treating dentist, which may have influenced the children's responses. Second, the studied sample was collected from a single medical institution, which may limit the generalizability of the findings. Third, all participating children were from the same age group and had no previous dental history, so the effects of age or prior dental experience could not be evaluated. Fourth, only

children with positive behavior according to Frankl's Behavior Rating Scale were included, and children with negative or defiant negative must be studied in future studies.

Conclusion:

Considering the limitations of this study, the camouflage syringe showed effectiveness in reducing pain-related injection in the maxillary region among children aged 6-9 years with no dental history according to the modified Wong-Baker FACES scale.

However, no difference was observed between males and females in terms of pain self-expression, whether the conventional syringe or the camouflage syringe was used.

More studies are needed to investigate the effectiveness of the camouflage syringe in different age groups of children and children with a history of negative experience.

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