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Unsweetened ice popsicles impart a positive feeling and reduce self-mutilation after paediatric dental treatment with local anaesthesia

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Aim. The purpose of the current study was to assess whether an unsweetened ice-popsicle imparts a positive feeling to children after dental treatment in which local anaesthesia is administered, and whether it reduces the tendency of children to self-mutilate (bite the lip, cheek or tongue) after the administration of local anaesthesia.

Design. Crossover study of 31 children aged 4–11 years old who needed similar dental treatments on both sides of the mandible or maxilla under local anaesthesia. At the end of each appointment the child received a toy or an ice-popsicle especially made for this study. Patients and parents answered a questionnaire regarding the children's behaviour and feeling immediately after the treatment, and 10 and 30 min after receiving the ice-popsicle or toy.

Results. Children who received ice-popsicles after dental treatment under local anaesthesia felt less discomfort and suffered less soft tissue trauma than they did when they received a toy. Reduction in soft tissue trauma was evident 10 min after receiving the ice-popsicles.

Conclusion. Licking of an ice-popsicle after dental treatment with local anaesthesia reduces the feeling of discomfort and the biting of soft tissue and self- mutilation.

Introduction

Self-mutilation, the biting of the soft tissues of the mouth (cheek, lip, tongue) when they are still anaesthetized, is one of the most common complications of dental treatment under local anaesthesia, particularly among children. This trauma can cause swelling and pain as the anaesthesia diminishes[1]. The main reason for such self-mutilation is that anaesthesia of the soft tissue lasts longer than that of the pulp, and the patient leaves the clinic with different areas of his/her mouth still anaesthetized. The duration of local anaesthesia differs according to the type of tissue (pulp or soft tissue), area of injection (maxilla or mandible) and the anaesthetic solution. For example, lidocaine 2% with epinephrine 1:100,000 anaesthetises the pulp for 60–85 min, and soft tissues for 170–190 min[2]. Ice is recognized as a local anaesthetic[3] and a pain reliever[4]. Cold application has long been considered an inexpensive and easy way to relieve pain without medication. Indeed, many studies have demonstrated a positive effect of cold application on pain from injections. However, these studies were conducted in adults, not in children[5], and in medicine, and not dentistry. According to the 'gate control theory', suggested by Melzack and Wall in 1965[6], cold application reduces pain by providing a continuous stimulus, by decreasing the neural transmission of the thin non-myelinated neurons that transfer stimuli from the periphery, and by decreasing muscle fibre contraction.

The merit of giving presents to children as a reward in the dental office is generally agreed upon. It is commonplace for children to choose a gift at the end of dental treatment[7].

A clinical pilot study tested the effect of a sweetened ice-popsicle on children's discomfort following dental treatment under local anaesthesia[8]. Thirty children aged 5–11 years old underwent two dental treatments under

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local anaesthesia at two separate appointments. At the end of each session the children received a toy or a sweetened ice-popsicle. Both 10 and 30 min after the end of the treatment, children's feeling was more positive after receiving the sweetened ice-popsicle. This was especially true among the younger children. The question arises as to whether the greater relief was due to the cold effect of the ice, or the sweetness of the ice-popsicle.

The purpose of the current study was to assess whether an unsweetened ice-popsicle imparts a positive feeling to children after dental treatment in which local anaesthesia is administered, and whether it reduces the tendency of children to self-mutilate (bite the lip, cheek or tongue) after the administration of local anaesthesia.

Materials and methods

Thirty-one children participated in this prospective study, all of them treated at the Department of Paediatric Dentistry in the Hadassah School of Dental Medicine. A resident paediatric dentist (TB) performed all treatments. The Hadassah Human Subjects Institutional Board approved the study. Children's parents or guardians received oral and written explanation by a senior paediatric dentist from the department. Only after written informed consent was received was a child enrolled. All children who were invited agreed to participate in the study. None of the children dropped out of the study.

Inclusion criteria were healthy children, American Society of Anesthesiology (ASA) 1, who were in need of two similar dental treatments (fillings, pulpotomies, crowns or extractions) on both sides of the same jaw under local anaesthesia (crossover design), and with no need of sedative agents before treatment. Local anaesthesia, lidocaine 2% with epinephrine 1:100.000, was administered according to the routine procedure of our clinic. Supplementary anaesthesia was delivered when necessary, so that dental treatment was provided without pain.

At the end of each appointment children and parents were warned about biting of the numbed lips. The children received a reward, either a toy, such as a balloon or sticker, or an unsweetened ice-popsicle. Prior to the first treatment, the reward (toy or ice-popsicle) was randomly assigned by the toss of a coin. Each child received the other prize at the second visit. The unsweetened ice-popsicle was especially made and looked like a regular ice-popsicle (coloured pink and with a wooden stick), but was made of filtered boiled water and a red food dye (one teaspoon per litre). To isolate the effect of the cold application, no sugar or flavourings were added.

At the end of each session, the children and parents completed a questionnaire, assisted by one of the investigators; this served as a 'double check' to avoid bias (Fig. 1). A Visual Analogue Scale[9] with ratings from 0 (worst possible behaviour) to 10 (optimal behaviour) was used to assess children's behaviour. Immediately at the end of the treatment, and 10 and 30 min after receiving the prize (ice-popsicle or toy), parents were asked to assess their children's feeling of pain or discomfort.

In addition, each child described his/her feelings regarding the anaesthetised area, using the Wong-Baker Facial Rating Pain Scale[10]. This scale measures the unpleasantness or affective dimension of a child's pain experience, and is used with children aged 3–17 years old. The child is shown a set of six cartoon faces with varying facial expressions from smile/laughter to tears. Each face has a numerical value, from 0 to 5. The child selects the facial expression that best represents his/her experience of discomfort, the face 'which looks like how you feel deep down inside, not the face you show to the world'. The facial pain scale shows good construct validity as a self-report pain measure. The first two parts of the questionnaire (time 0, 10 min) was answered in the clinic and the last part (time 30 min) by phone; the children had the scale with the faces at home. The length of time the child licked the ice was measured without the child realizing. Each child served as his/her own control.

Statistical methods

To compare quantitative variables between two independent groups, the two-sample

Name: Time treatment ended:
Phone number: Appointment no.:
The tooth treated & the treatment: Toy/ice popsicle

Mark the appropriate answer:

1. Does the child complain about pain or discomfort?

Time 0	Time +10	Time +30
1. Yes	1. Yes	1. Yes
2. No	2. No	2. No
3. Unknown	3. Unknown	3. Unknown

2. Is the child biting or trying to bite his lip/tongue/cheek?

Time 0	Time +10	Time +30
1. Yes	1. Yes	1. Yes
2. No	2. No	2. No
3. Unknown	3. Unknown	3. Unknown

3. Is the child crying or yelling?

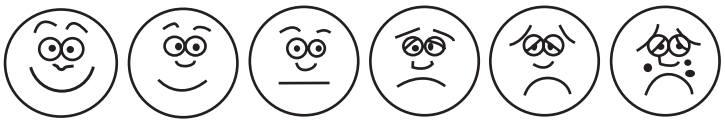
Time 0	Time +10	Time +30
1. Yes	1. Yes	1. Yes
2. No	2. No	2. No

4. For children who received ice, is the child licking the ice?

Time 0	Time +10	Time +30
1. Yes	1. Yes	1. Yes
2. No	2. No	2. No
3. Unknown	3. Unknown	3. Unknown

5. The child′s feeling:

0 - no pain 1 - very little pain 2 - slightly painful 3 - painful 4 - very painful 5 - unbearably pain



0	0	1	2	3	4	5
10+	0	1	2	3	4	5
30+	0	1	2	3	4	5

6. The child′s behaviour, rated from 0 to 10, using a Visual Analogue Scale

0	
+10	
+30	

0 _____ **10**

7. The questionnaire was filled in by:

Time 0	Time +10	Time +30
1. Mother	1. Mother	1. Mother
2. Father	2. Father	2. Father
3. Other_____.	3. Other_____.	3. Other_____.

Remarks:_____

Fig. 1. Questionnaire filled in immediately after treatment, and 10 and 30 minutes after treatment by the patients and their parents, with assistance of investigators.

t-test and the non-parametric Mann–Whitney test were applied. Using the Kruskal–Wallis non-parametric test, quantitative variables were compared between three groups of Wong and Baker FRPS categories: no pain –0, slight pain – 1 or 2 and painful – 3, 4 and 5). The paired *t*-test was applied for testing change of quantitative variables. The McNemar and McNemar–Bowker tests were used for assessing change between two qualitative variables.

Most tests were two-tailed, except for one instance (when comparing self mutilation with an ice-popsicle and a toy) in which the

aprioric hypothesis was that ice is better than a toy, one-tailed was used. A *P*-value of 0.05 or less was considered statistically significant. *P*-values were presented for statistically significant differences.

Prior to commencing the study a sample size of 31 was determined to achieve statistical power of 80% with alpha of 0.05.

Results

Thirty-one children participated in this study (13 girls, 18 boys). The children's ages ranged from 4 to 11 years (15 children aged 4–6.5, 16 children aged 6.5–11).

Overall, 62 treatments (fillings, pulpotomies, crowns and extractions) were performed, 24 in the maxilla and 38 in the mandible. The mean duration of treatments was 38 ± 7.5 min; the two treatments were one week apart. Prior to ice, nine children reported no pain, 16 slight pain and six considerable pain (Table 1). Prior to the toy, 16 reported no pain, nine slight pain and six considerable pain (Table 2).

Ten minutes after receiving the ice 32% of the children felt better; 30 min after, 42% felt better than they had immediately after the treatment. None of the children felt worse after licking the ice (Table 1). In contrast, 10 min after receiving the toy, 13% felt better and 26% felt worse (Table 2). Thirty minutes after receiving the toy, 29% felt better and 6% felt worse than they had immediately after the treatment. The difference between those who felt better and those who felt worse was not significant.

The ice significantly reduced discomfort within the first 10 min following dental treatment, with 36% of the children reporting improvement and 0% reporting worsening of pain (Table 3). In contrast, after receiving the toy, reduction in pain was reported in 16% and increased pain in 13% (Table 4). During the first 30 min after treatment, reduction in pain or discomfort was significant following

Table 1. Treatment followed by ice Children's sensation of pain according to the Wong-Baker Scale (WBS): 10 and 30 minutes after dental treatment, compared to immediately after dental treatment.

		Degree of pain at 10 min (Count, % of total)			Degree of pain at 30 min (Count, % of total)		
		No pain	Slight pain	Painful	No pain	Slight pain	Painful
Degree of pain immediately after treatment (Count, % of total)	No pain (9, 29%)	9 (29%)	0 (0%)	0 0%)	9 (29%)	0 (0%)	0 (0%)
	Slight pain (16, 51%)	9 (29%)	7 (22%)	0 (0%)	10 (32%)	6 (19%)	0 (0%)
	Painful (6, 19%)	0 (0%)	1 (3%)	5 (16.1%)	0 (0%)	3 (10%)	3 (9%)
Total	Total (31, 100%)	18 (58%)	8 (25%)	5 (16%)	19 (61%)	9 (29%)	3 (9%)

No pain – Wong-Baker value of 0.
Slight pain – Wong-Baker values of 1or 2.
Painful – Wong-Baker values of 3, 4 or 5.

Table 2. Treatment followed by a toy Children's sensation of pain according to the Wong-Baker Scale (WBS): 10 and 30 minutes after dental treatment, compared to immediately after dental treatment.

		Degree of pain at 10 min (Count, % of total)			Degree of pain at 30 min (Count, % of total)		
		No pain	Slight pain	Painful	No pain	Slight pain	Painful
Degree of pain immediately after treatment, (Count, % of total)	No pain (16, 52%)	10 (33%)	6 (19%)	0 (0%)	14 (45%)	1 (3%)	1 (3%)
	Slight pain (9, 29%)	1 (3%)	6 (19%)	2 (6%)	3 (10%)	3 (19%)	0 (0%)
	Painful (6, 19%)	1 (3%)	2 (7%)	3 (10%)	2 (7%)	4 (13%)	0 (0%)
Total	Total (31, 100%)	12 (39%)	14 (45%)	5 (16%)	31 (61%)	19 (36%)	11 (3%)

No pain – Wong-Baker value of 0.
Slight pain – Wong-Baker values of 1or 2.
Painful – Wong-Baker values of 3, 4 or 5.

Table 3. Treatment followed by ice The feeling of pain/discomfort immediately after the dental treatment, time = 0 compared to 10 and 30 minutes after the treatment.

		Pain/discomfort at 10 min		Pain/discomfort at 30 min	
		Yes	No	Yes	No
Pain/discomfort, time = 0	Yes 24 (77%)	13 (42%)	11 (35%)	12 (39%)	12 (39%)
	No 7 (23%)	0 (0%)	7 (23%)	0 (0%)	7 (22%)
	Total 31 (100%)	13 (42%)	18 (58%)	12 (39%)	19 (61%)

Table 4. Treatment followed by a toy The feeling of pain/discomfort immediately after the dental treatment, time = 0 compared to 10 and 30 minutes after the treatment.

		Pain or discomfort, time 10, praise		Pain or discomfort, time 30, praise	
		Yes	No	Yes	No
Pain or discomfort, time 0, praise	Yes 21 (68%)	16 (51%)	5 (16%)	13 (42%)	8 (26%)
	No 10 (32%)	4 (13%)	6 (19%)	1 (3%)	9 (29%)
	Total 31 (100%)	20 (64%)	11 (35%)	14 (45%)	17 (55%)

both types of reward. Improvement was greater following the ice-popsicle than the toy, 39% and 26% respectively. This difference was significant ($P = 0.004$).

The number of children who were biting themselves at the time they received the ice-popsicle or toy was similar, 12 and 13 respectively. However, 10 min later, only three children with ice- popsicles were still biting, compared to 11 with the toy ($P = 0.039$).

Rating the child behaviour on a VAS from 0 to 10, (question number 6 of the questionnaire 0 (worst possible behaviour) and 10 (optimal behaviour), there was significant improvement after licking the ice, particularly during the first 10 min. After receiving the toy, the difference was significant only after 30 min. The behaviour improved as time progressed following both treatments.

There was no statistical difference between parents' report of their children's pain or discomfort after treatment, and children's feeling using the Wong and Baker PFRS.

Gender, age, and the jaw treated (mandible or maxilla) did not affect reduction in pain, biting or crying.

About half of the children (18 out of 31) received the ice-popsicle at the end of the first appointment, and about half (13 out of 31) – at the end of the second appointment. There was no statistical difference in outcomes when the ice was given at the first or second visit.

The length of time the children licked the ice ranged from 1 to 10 min: 12 children licked it between 1 and 3 min, and 19 children licked it 4 min or more. The length of time that children licked the ice did not significantly correlate with their pain or discomfort.

Discussion

The ice-popsicle was more effective than the toy in reducing pain, discomfort and soft tissue trauma. Fewer children bit themselves after receiving the ice-popsicle.

In a previous study, using conventional sweet popsicles[8], we found similar results. The use of unsweetened ice in the current study demonstrates that the ice-popsicle is beneficial, even when not sweetened. The improvement observed, evident 10 min after treatment, supports Saul *et al.*'s suggestion

that ice can be an effective non-pharmacological intervention for pain management, and that its application for longer than 10 min does not increase benefit[5]. Nonetheless, analgesia from the ice can last up to 30 min. According to the 'gate control theory', cold application from a non-anesthetized region may arouse the cells that regulate pain pulses ('green cells')[6]. Likewise, the mild pressure of the ice-popsicle itself, on the lip, for example, may stimulate 'green cells' and reduce pain.

In the current study, differences in feeling following receipt of an ice-popsicle or a toy decreased between 10 and 30 min after the dental treatment. The children licked the ice for up to 10 min. It seems that from that point on the positive effect of the ice naturally declined. Saul *et al.*[5] found the while the application of hot or cold was effective in reducing pain, the application of cold was more so, with maximal effect immediately after its application. Another study found the analgesic effect resulting from the application of a cold material to commence about 4 min after the application of ice, and to last for at least 30 min. As in the current study, ice application for a longer period did not increase the efficacy of the treatment[11].

Since it is very difficult for a child to differentiate pain from unpleasant feeling due to numbness in the lips and tongue, we considered both as possible reasons for crying and discomfort after treatment and for biting soft tissue. The reduction of self mutilation (biting on numb lip, cheek or tongue) after receiving an ice-popsicle may have resulted from the children's mouths being physically occupied by the ice-popsicle. The ice-popsicle may also have distracted children's attention away from their pain. Other studies have shown that distraction may help reduce the perception of pain[12,13].

This study did not include dental treatment without reward, as a control group, since every child who receives dental treatment at our clinic is accustomed to receiving some kind of prize or reward. In addition, we think that a toy reward, which is the common practice, is a very good control group.

The crossover design is a strength of this study. Determination of first treatment by coin toss assured randomised assignment. Shortcomings of the study are that a number of dentists performed the treatments, and the treatments were not identical. In addition, although each child received similar treatments in both sessions, the treatments between children were not identical. We did not examine whether, for instance a child who received a crown reacted differently from a child who had a tooth extracted.

Conclusion

Children who received unsweetened ice-popsicles after dental treatment under local anesthesia reported feeling better, suffered less from soft tissue trauma, and bit themselves less than when they received a toy as a reward.

What this paper adds

- Evidence that an unsweetened ice-popsicle after dental treatment reduces pain and discomfort, and also self-mutilating by biting.
- The suggestion that the positive benefit of an ice-popsicle following dental treatment may be due to its coldness.

Why this study is important to paediatric dentists

- In light of the custom of giving small gifts to children after dental treatment, the simple choice of an ice-popsicle provides comfort and reduces soft tissue biting.

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