Effect of Massage on the Efficacy of the Mental and Incisive Nerve Block

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The purpose of this trial was to assess the effect of soft tissue massage on the efficacy of the mental and incisive nerve block (MINB). Thirty-eight volunteers received MINB of 2.2 mL of 2% lidocaine with 1 : 80,000 epinephrine on 2 occasions. At one visit the soft tissue overlying the injection site was massaged for 60 seconds (active treatment). At the other visit the crowns of the mandibular premolar teeth were massaged (control treatment). Order of treatments was randomized. An electronic pulp tester was used to measure pulpal anesthesia in the ipsilateral mandibular first molar, a premolar, and lateral incisor teeth up to 45 minutes following the injection. The efficacy of pulp anesthesia was determined by 2 methods: (a) by quantifying the number of episodes with no response to maximal electronic pulp stimulation after each treatment, and (b) by quantifying the number of volunteers with no response to maximal pulp stimulation (80 reading) on 2 or more consecutive tests, termed anesthetic success. Data were analyzed by McNemar, Mann-Whitney, and paired-samples *t* tests. Anesthetic success was 52.6% for active and 42.1% for control treatment for lateral incisors, 89.5 and 86.8% respectively for premolars, and 50.0 and 42.1% respectively for first molars ($P = .344$, 1.0, and .508 respectively). There were no significant differences in the number of episodes of negative response to maximum pulp tester stimulation between active and control massage. A total of 131 episodes were recorded after both active and control massage in lateral incisors (McNemar test, $P = 1.0$), 329 (active) versus 316 (control) episodes in the premolars (McNemar test, $P = .344$), and 119 (active) versus 109 (control) episodes respectively for first molars (McNemar test, $P = .444$). Speed of anesthetic onset and discomfort did not differ between treatments. We concluded that soft tissue massage after MINB does not influence anesthetic efficacy.

Key Words: Dental pulp anesthesia; Lidocaine; Mental and incisive nerve block.

Mandibular teeth are more susceptible to failed anesthesia than maxillary teeth as a result of difficulties in blocking the inferior alveolar nerve and collateral innervations.^{1–6} A number of alternative and

supplementary techniques have been described to overcome failure of the conventional inferior alveolar nerve block (IANB) injection, including infiltration anesthesia, intraligamentary anesthesia, intraosseous anesthesia, and mental and incisive nerve block (MINB).^{7–12} Few objective data have been published on the efficacy of the MINB as a supplemental or even alternative technique to IANB for lower anterior and premolar teeth. The reported failure rate of MINB is very low for pulp anesthesia in premolars.⁸ It may,

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however, be less effective for other teeth; Nist et al⁸ reported a very low success rate of pulp anesthesia in first molars and lateral incisors after MINB alone. Advantages of MINB may include less patient discomfort than an IANB and a lack of lingual tissue anesthesia.⁸ In addition, anatomical landmarks for effective anesthesia may be less challenging, and there may be less risk of postoperative discomfort and trismus because the injection is not a deep block involving the muscles of mastication. The MINB does not require specialized equipment as required for intraosseous or intraligamentary methods, and conventional syringes can be used.

Anecdotal reports suggest that tissue massage may encourage the movement of local anesthetic agent into the mental foramen and improve the efficacy and the distribution of anesthesia. This has never been validated in a clinical trial.

The aim of this study was to assess the effect of soft tissue massage on the efficacy and distribution of anesthesia following MINB, using 2% lidocaine with 1 : 80,000 epinephrine. Secondary outcome measures included the speed of onset of anesthesia and the discomfort associated with MINB and soft tissue massage.

The null hypothesis tested was that soft tissue massage at the injection site has no influence on the efficacy, onset, and distribution of pulp anesthesia or on the discomfort associated with MINB injection.

MATERIAL AND METHODS

The study was a prospective randomized double-blind crossover trial. The primary outcome measures were the effects of soft tissue massage on the efficacy and distribution of dental pulp anesthesia following MINB, using 2% lidocaine with 1 : 80,000 epinephrine. Secondary outcome measures were the speed of onset of anesthesia and the discomfort associated with MINB and soft tissue massage. A formal power calculation, based on success rates reported in a previous study,¹³ indicated that a sample size of 38 subjects would provide 80% power to detect a difference of 30 points (60 versus 90%) in the success rate assuming a significance level of 5%.

Ethical approval was obtained from the local ethical review board. Subjects recruited to the study provided formal, written consent and met the following inclusion criteria:

1. Healthy adults, aged 18 years and above.
2. Vital lower lateral incisor, first or second premolar, and first molar on one side of the mouth.

Exclusion criteria were:

1. Subjects with dental pain at the time of the study.
2. Unstable heart disease.
3. Pregnancy.
4. Allergies to local anesthetic agents or latex.
5. Oral/facial paresthesia.

Volunteers were required to attend on 2 occasions, at least 1 week apart. On both occasions, a standard MINB comprising 2.2 mL of 2% lidocaine with 1 : 80,000 epinephrine (Lignospan Special, Septodont, Saint-Maur-des-Fosses, France) was given by a single operator. Injections were administered over 60 seconds using a standard aspirating dental cartridge syringe (Ultra Safety Plus XL Syringe, Septodont) fitted with a 30-gauge dental needle. After injection, an operator who was not involved in assessing the outcome massaged the region of the injection for 1 minute, either on the soft tissue site of injection (active treatment) or the crowns of the premolar teeth (control treatment). The choice of active or control treatment was randomized and the trial was double blind because the volunteer and the operator assessing the outcome were blinded to the postinjection treatment.

Objective assessment of tooth anesthesia was assessed by stimulating teeth before and after injection with an Analytic Technology Pulp Tester (Analytic Technology, Redmond, Wash). The pulp tester was set to deliver a 0–80 digital reading on a rate setting of 5, corresponding to a nonlinear increasing voltage, 0 to maximum, over 30 seconds. Calibration of the pulp tester demonstrated a maximum voltage of 270 V at an output impedance of 140 kΩ. Volunteers were requested to note the moment at which the stimulus was first detected, and the corresponding value was recorded from the analogue scale (0–80).

Testing was performed on the mandibular first molar, first premolar (or second premolar in the absence of a first premolar), and lateral incisor on the test side of the mandible twice before injection to establish a baseline reading. Pulp sensitivity assessment was then carried out on test teeth every 2 minutes for the first 10 minutes postinjection and then at 5-minute intervals to 45 minutes. The timings were measured by a stop watch.

The efficacy of pulp anesthesia was determined by 2 methods:

1. By quantifying the number of episodes with no response to maximum electronic pulp stimulation (80 reading) after each treatment.
2. By defining anesthetic success as no response to maximal pulp stimulation (80 reading) on 2 or more consecutive tests.

Figure 1. Percentage of volunteers with no response to electronic pulp testing at time intervals after mental and incisive nerve block and active or control massage in lateral incisors.

An unanesthetized contralateral maxillary canine was also tested as a control before MINB injection and at 10 and 45 minutes postinjection. At each registration point, participants were also invited to indicate if their lip and teeth felt numb.

The onset of pulpal anesthesia was considered as the first of 2 or more consecutive episodes of no sensation to maximal stimulation (80 readings). The duration of pulpal anesthesia was similarly taken as the time from the first of at least 2 consecutive maximum readings without sensation until the onset of more than 2 responses at less than maximum stimulation or the end of the 45 minutes of the trial, whichever was sooner.

Participants were also requested to assess the discomfort associated with injection and massage (active or control) on a standard 100-mm visual analogue scale with end points labeled “no pain” and “unbearable pain.”

Data were analyzed in SPSS (SPSS 17.0, SPSS Inc., Chicago, Ill) by McNemar, Mann-Whitney, and paired *t* tests.

RESULTS

Thirty-eight volunteers completed the study. These comprised 12 males (31.5%) and 26 females (68.4%). Their mean age was 23.9 years (SD 4.6 years).

The percentage of volunteers with no sensation to electronic pulp stimulation in lateral incisors at time intervals after MINB is shown in Figure 1. A total of 131 episodes of negative response were recorded after both active and control massages.

For premolars, there was no significant difference between the number of episodes of no sensation on maximal stimulation after active and control massage, these being 329 versus 316 respectively (McNemar test, $P = .344$; Figure 2). Similarly, for first molars, no significant difference was found in the percentage of volunteers with no sensation on maximal stimulation between active and control treatment, 119 versus 109 episodes (McNemar test, $P = .444$; Figure 3).

When anesthetic success was defined as no response to maximal electronic pulp stimulation (80 reading) on 2 or more consecutive episodes of testing, active massage successfully anesthetized the lateral incisors of 20 volunteers (52.6%), whereas the control treatment anesthetized 16 (42.1%) (Table 1). This difference was not significant (McNemar test, $P = .344$). Thirty-four volunteers (89.5%) secured pulp anesthesia in premolars after active massage, compared to 33 (86.8%) after control treatment (Table 1). This difference was not significant (McNemar test, $P = 1.0$). Nineteen volunteers (50.0%) secured pulp anesthesia in first molars after active massage, compared to 16 (42.1%) after control treatment (Table 1). This difference was not significant (McNemar test, $P = .508$).

Using the above definition of anesthetic success to compare the test teeth, significantly more premolars (34 volunteers; 89.5%) were successfully anesthetized than first molars (19 volunteers; 50%) and lateral incisors (20 volunteers; 52.6%) following MINB and active massage (McNemar test, $P = .001$, 0.001 respectively). There was no significant difference in successful anesthesia between first molars and lateral incisors (McNemar test, $P = 1.0$).

Figure 2. Percentage of volunteers with no response to electronic pulp testing at time intervals after mental and incisive nerve block and active or control massage in premolars.

Similarly, after MINB and control massage, anesthetic success was significantly greater in premolars (33 volunteers; 86.8%) than in first molars (16 volunteers; 42.1%) and lateral incisors (16 volunteers; 42.1%) (McNemar test, $P = .001$, 0.001 respectively). Again there was no significant difference between first molars and lateral incisors (McNemar test, $P = 1.0$).

Nonparametric tests were employed to analyze differences in the onset and duration of pulpal anesthesia after MINB and active or control massage because the data were not normally distributed. No significant differences were seen between active and control massage in terms of the median onset time and duration of pulpal anesthesia in lateral incisors, premolars, and first molars (Tables 2 and 3).

MINB plus active massage resulted in a mean visual analogue scale score of 3.5 (SD 3.8), whereas the score for MINB plus control treatment was 2.2 (SD 2.8). This difference was not significant (paired-samples test, $t = 1.88$, $P = .067$).

DISCUSSION

Previous investigations have assessed 2 factors that might influence the efficacy of MINB. Joyce and Donnelly¹³ compared injections within and outside the mental foramen and found no difference in the success of pulpal anesthesia for first premolars; however, the second premolar and canine teeth were more likely to

Figure 3. Percentage of volunteers with no response to electronic pulp testing at time intervals after mental and incisive nerve block and active or control massage in first molars.

Table 1. Anesthetic Success (2 or More Consecutive Episodes of Negative Pulp Testing) in Lateral Incisors, Premolars, and First Molars After Mental and Incisive Nerve Block (MINB) Plus Active or Control Massage

<i>Anesthetic Success</i>	<i>Lateral Incisors</i>				<i>Premolars</i>				<i>First Molars</i>			
	<i>Failure</i>		<i>Success</i>		<i>Failure</i>		<i>Success</i>		<i>Failure</i>		<i>Success</i>	
	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>
MINB with active massage	18	47.4	20	52.6	4	10.5	34	89.5	19	50.0	19	50.0
MINB with control massage	22	57.9	16	42.1	5	13.2	33	86.8	22	57.9	16	42.1

Table 2. Onset (min) of Pulpal Anesthesia in Lateral Incisors, Premolars, and First Molars After Mental and Incisive Nerve Block (MINB) Plus Active or Control Massage

<i>Onset of Pulp Anesthesia</i>	<i>MINB With Soft Tissue Massage</i>			<i>MINB With Dummy Massage</i>		
	<i>Lateral Incisors</i>	<i>Premolars</i>	<i>First Molars</i>	<i>Lateral Incisors</i>	<i>Premolars</i>	<i>First Molars</i>
Mean	3.3	2.4	5.0	4.4	2.4	4.8
Median	2.0	2.0	6.0	4.0	2.0	4.0
Range	2–8	2–4	2–10	2–10	2–4	2–8

Table 3. Duration (min) of Pulpal Anesthesia in Lateral Incisors, Premolars, and First Molars after Mental and Incisive Nerve Block (MINB) Plus Active or Control Massage

<i>Duration of Pulp Anesthesia</i>	<i>MINB With Soft Tissue Massage</i>			<i>MINB With Dummy Massage</i>		
	<i>Lateral Incisors</i>	<i>Premolars</i>	<i>First Molars</i>	<i>Lateral Incisors</i>	<i>Premolars</i>	<i>First Molars</i>
Mean	21.5	37.5	19.5	30.1	40.1	25.2
Median	17.0	41.0	18.0	31.0	43.0	26.0
Range	2–43	23–43	5–43	16–43	21–43	6–43

be anesthetized with the former method. Whitworth et al¹⁴ studied the effect of injection speed on the efficacy of MINB for pulpal anesthesia in mandibular teeth and noted no difference in success between rapid and slow injections.

In the present study, based on the number of episodes of no responses to maximal pulp tester stimulation (80 reading), the incidence of pulpal anesthesia did not differ significantly between MINBs with active and control massages.

Similarly, when 2 or more consecutive episodes of pulp testing without sensation was employed as the definition of anesthetic success, there was no significant difference between MINBs with active and control massage. Overall anesthetic success across the 45-minute trial period was 47.4% in lateral incisors, 88.2% in premolars, and 46.1% in first molars. These results are comparable to those of Whitworth and colleagues¹⁴ with the same definition of success and the same anesthetic solution (pulpal anesthesia in 38.5% of lateral incisors, 81.8% of first premolars, and 48.7 % of first molars).

The present results are also in keeping with those of the study of MINB by Joyce and Donnelly.¹³ These

authors employed 0.9 mL of 2% lidocaine with 1 : 100,000 epinephrine, compared with 2.2 mL of 2% lidocaine with 1 : 80,000 epinephrine in our study, but the former defined success as a single episode of maximal electronic stimulation (80 reading) without sensation. Anesthetic success for injection given inside the mental foramen was 88% for first premolars, 93% for second premolars, and 94% for canines. When injections were given outside the mental foramen, the success rates were 73% for first premolars, 76% for second premolars, and 58% for canines.

Nist et al⁸ assessed the degree of pulpal anesthesia after MINB alone and in combination with an IANB using 2% lidocaine with 1 : 100,000 epinephrine. Anesthesia was considered to be successful when no response to maximal electronic stimulation (80 reading) occurred within 15 minutes of injection and was sustained for 60 minutes. Anesthetic success after MINB was 8% in lateral incisors, 30% in first premolars, 35% in second premolars, and 10% in first molars. These results are not comparable to those of the present investigation, and this may be the result of dose variations, experimental protocol, or simply a more stringent definition of anesthetic success compared to the current study. In the

study of Nist et al⁸ the combination of MINB and IANB significantly improved anesthetic success to 60% in lateral incisors, 90% in first premolars, 85% in second premolars, and 70% in first molars.

The present study was performed on vital asymptomatic teeth. It is unknown if similar results would be obtained in symptomatic teeth.

In the present study, the overall median onset times of pulpal anesthesia were 3.0 minutes in lateral incisors, 2.0 minutes in premolars, and 5.0 minutes in first molars. These results are similar to those obtained by Whitworth and colleagues,¹⁴ who employed an identical definition of onset and recorded onset times of 5.6 minutes (SD, 3.0 minutes) for lateral incisors, 5.1 minutes (SD, 2.6 minutes) for premolars, and 7.0 minutes (SD, 4.3 minutes) for first molars. The increased onset time in molars compared to premolars is most probably the result of the increased distance of diffusion along the mandibular canal required for molar anesthesia. The greater time for lateral incisor anesthesia may be the result of “coring,” in which those fibers that supply the anterior teeth are deeper in the nerve trunk compared to the premolar supply, thus necessitating a longer time for deeper penetration into the nerve bundle.

Overall, the median duration of pulpal anesthesia in the present study was 24.0 minutes for lateral incisors, 42.0 minutes for premolars, and 22.0 minutes for first molars. This is comparable to the results of Whitworth and colleagues,¹⁴ with an identical definition of duration in lateral incisors and first molars, but not in premolars. The overall mean durations of pulpal anesthesia in their study were 19.0 minutes for lateral incisors, 28.5 minutes for premolars, and 19.1 minutes for first molars, similar to those of Joyce and Donnelly,¹³ which were 22.6 minutes for first premolars, 23.1 minutes for second premolars, and 21.9 minutes for canines. Median duration of pulpal anesthesia in the present investigation was longer than that of Joyce and Donnelly¹³ in premolars. This difference may be a result of dose variation or the variation in epinephrine concentration between the 2 studies. Similar durations of anesthesia were also reported (30 minutes for premolars) by Nist and colleagues.⁸

CONCLUSIONS

Digital soft tissue massage after MINB has no significant influence on the occurrence or duration of pulp anesthesia in mandibular lateral incisors, premolars, or

first molars. No difference in discomfort was noted between MINB given with active or dummy massage.

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