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Effect of alkalinisation of lignocaine for intraoral nerve block on pain during injection, and speed of onset of anaesthesia

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Abstract

Injections of lignocaine as local anaesthetic for pain control in oral and maxillofacial surgery can themselves be painful. The time of onset of anaesthesia is from 3 to 5 min. Sodium bicarbonate has been used worldwide to reduce both these drawbacks to the injection, so making procedures more acceptable. This randomised prospective trial of 100 patients aged 18–55 years who were given 3 nerve blocks (inferior alveolar, lingual, and long buccal) was designed to assess the effect of alkalinisation of the lignocaine solution with sodium bicarbonate. All patients were given 2% lignocaine hydrochloride with adrenaline 1:80,000 and 50 patients were randomly allocated to be given 8.4% sodium bicarbonate in a 1/10 dilution. Pain was measured on a visual analogue scale (VAS). No patient given the injection with sodium bicarbonate complained of pain, compared with 39/50 (78%) not given sodium bicarbonate ($p < 0.0001$). The mean (SD) time (seconds) to onset of local anaesthesia in the group given sodium bicarbonate was 34.4 (9.8) compared with 109.8 (31.6) in the control group ($p < 0.001$). Our results have confirmed the efficacy of the alkalinised local anaesthetic solution in reducing pain on injection and resulting in quicker onset of anaesthesia.

Keywords: Lidocaine; Alkalinisation; Sodium bicarbonate; Pain; Onset of anaesthesia

Introduction

The injection of local anaesthetic agents into the skin and mucous membranes is one of the most common minor surgical manoeuvres. It is often the only painful part of a dental procedure.

Although the patient may be told that the injection will feel "like a mosquito bite", it is often much worse.[1] To minimise the patient's discomfort during a procedure has obvious benefits for both the patient and the surgeon. Although it is short-lived, the perceived pain of the injection of local anaesthetic is bad enough for some patients to decline further interventions under local anaesthesia. To give additional analgesics, or sedatives, or both, can be impractical and time consuming; it is even at times contraindicated.[2] Of the many reasons for pain at the site of injection, the acidity of the solution is thought to be important. This can be neutralised with sodium bicarbonate and used for nerve blocks. There is overwhelming evidence that buffered local anaesthetics cause less pain during injection, and some patients have reported no pain at all.[3]

We have studied the effect of adding sodium bicarbonate to the local anaesthetic solution on the pain of injection and also on the time before for the onset of anaesthesia.

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Table 1
Results ($n = 50$ in each group).

Variable	Lignocaine without sodium bicarbonate	Lignocaine with sodium bicarbonate	p value
Pain	39	0	<0.0001
No pain	11	50	
Mean (SD) onset of anaesthesia (s)	109.8 (31.6)	34.4 (9.8)	<0.001

Each group was given 2% lignocaine plus 1:80,000 adrenaline.

Patients and methods

This prospective study was approved by the human studies review board, after which 100 healthy adult patients aged 18–55 years gave their written consent to participate. They were among patients who were to have procedures under local anaesthesia in the mandibular region.

Assuming that 80% of all patients given local anaesthetic injections have pain during injection, and anticipating a 75% reduction in pain using solutions containing sodium bicarbonate, the sample size was calculated that would have a level of significance of 5% with a power of 80%.

All patients were given standard nerve blocks: inferior alveolar, lingual, and long buccal nerve. All 100 patients were given all three nerve blocks. All patients selected were evaluated for physical status and patients with systemic diseases that contraindicated injections of lignocaine with adrenaline were excluded from the study. Patients were randomly divided into two groups of 50 each using simple random sampling technique. Slips of paper containing numbers 1–100 were numbered randomly divided into two groups: control and study group. Each patient picked a slip and had the treatment to which they had been allotted randomly.

The control group was given lignocaine hydrochloride with adrenaline 1:80,000 solution by injection. The study group was given the same solution but with sodium bicarbonate.[2,4] A total of 8.4% sodium bicarbonate 3 ml was added to a 30 ml vial containing 2% lignocaine hydrochloride with 1:80,000 adrenaline solution, which yielded a 1/10 dilution.

All patients had the procedure explained to them. Both the operators and patients were unaware of which anaesthetic the patient had been given. The two groups had their pain evaluated during injection and onset of anaesthesia. All injections in both groups were given using non-pyrogenic, non-toxic, sterile, single-use syringes with a luer lock and 25G 1.5 in. needle. A maximum of 2.5 ml solution was used for all three blocks.

Pain during injection was assessed using a four-point scale: 0 = no pain, 1 = mild pain (pain reported only in response to questioning and without any behavioural signs), 2 = moderate pain (pain reported in response to questioning and accompanied by signs, or pain reported spontaneously without questioning), and 3 = severe pain (strong vocal response or response accompanied by grimaces, withdrawal of the arm, or tears).[5] Pain during injection was defined as pain that was described by the patient on a four-point Visual Analogue Scale (VAS)[5] during injection of the solution and not on the needle-prick itself.

The time of onset of anaesthesia is defined as the first sensation of numbness or tingling in the anaesthetised region. It was calculated from the point of retrieval of the needle after the injection. A straight probe was used to assess the onset of anaesthesia by inserting it in the gingival sulcus of the teeth in the area of anaesthesia. The results were quantified and analysed.

Data from the VAS were analysed using the chi square test, and times of onset of anaesthesia were analysed using Student's t-test. Probabilities of less than 0.05 were accepted as significant.

Results

The pH of both solutions were evaluated using a standard pH meter; 3.05 was the measured pH for 2% lignocaine with 1:80,000 adrenaline (Lignox 2% A, Warren Pharmaceuticals, India) and 7.38 for 2% lignocaine with 1:80,000 adrenaline with a 1/10 addition of 8.4% sodium bicarbonate.

Among patients given solutions without sodium bicarbonate, 11 experienced no pain, 31 mild pain, 8 moderate pain, and 0 severe pain during injection, from which can be deduced

Table 2
Comparison of onset of anaesthesia in the study groups.

	Group I (patients receiving 2% lidocaine with 1:80,000 adrenaline solution) Mean ± SD	Group II (patients receiving 2% lidocaine with 1:80,000 adrenaline solution alkalinised with sodium bicarbonate Mean ± SD	t* value	Significance
Onset of anaesthesia (s)	109.76 ± 31.63	34.40 ± 9.82	16.08	$p < 0.001$ highly significant

*unpaired Student's t- test