Nausea Control by Needling at Acupuncture Point Neiguan (PC6) During an Intraoral Impression-Taking Procedure

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Abstract
The objective of this study was to evaluate the effectiveness of acupuncture point PC6 (Neiguan) in controlling nausea during intraoral impression taking. This study was conducted in Piracicaba, São Paulo, Brazil. The sample consisted of 33 adult volunteers with nausea, who were randomly divided into control and study groups, and treated with non-penetrating sham acupuncture and real acupuncture, respectively, at acupoint PC6. The two groups had two maxillary impressions taken, one prior to acupuncture and the other after acupuncture. The nausea assessment was made using the visual analog scale, Gagging Severity Index (GSI), and Gagging Prevention Index. Volunteers’ expectation that nausea would be reduced through acupuncture was also assessed. For statistical analysis, we used the t test and the Spearman correlation (p < 0.05). When assessed by Gagging Severity Index/Gagging Prevention Index, nausea was reduced in the real acupuncture group (p < 0.01). In the visual analog scale assessment, similar reductions of nausea were noted in both groups (p > 0.05). No correlation existed between the expected and the actual reductions in nausea. Our results indicate that acupoint PC6 was effective for controlling nausea during the maxillary impression-taking procedure. Patients’ expectation did not influence the results.
1. Introduction

The occurrence of nausea while performing dental procedures is a major constraint to providing good-quality dental treatment, especially when it is necessary to take impressions of the dental arches. Moreover, the treatment plan may be compromised by the need to limit the impact of the gag reflex, and in some cases, other levels of intervention, such as anesthesia (local or general) or conscious sedation may be required [1]. The exact prevalence of the gag reflex in the general population is unknown [2], but it undoubtedly affects many patients. Furthermore, studies, especially controlled studies, on nausea control with the use of acupuncture in dentistry are lacking. Therefore, this is an important controlled study, which gives evidence of the clinical application of acupuncture.

In Western medicine, a working definition of the gag reflex is as follows: “a stimulated, protective, reflex response to prevent material from entering the mouth or oropharynx. Gagging stimuli can be physical, auditory, visual, olfactory, or psychologically mediated and the muscular contractions provoked may result in vomiting” [2]. Some people have a reduced or absent gag reflex, whereas others have a pronounced reflex [3, 4]. One study found that the gag reflex was absent in 37% of 140 healthy people [4]. Some articles refer to nausea as an elementary reflex, present since birth [3, 5], and on study mentions that the reflex develops in the weaning period [6].

The etiology of nausea is multifactorial. Factors influencing nausea may be local or systemic, anatomic, psychological, and iatrogenic [3]. According to the origin of the causes, nausea can be categorized as somatogenic (when it is started by physical or tactile stimuli) or psychogenic (when it is induced by psychological stimuli) [7]. Five areas of the oral cavity are considered trigger zones for the gag reflex: the folds of palatoglossus and palatopharynge, the base of the tongue, palate, uvula, and posterior pharyngeal wall. Psychogenic nausea may be induced without direct physical stimulation, and, in its most severe forms, just the thought of a dental intervention may be enough to induce it [2]. Memories of negative past experiences or learned beliefs experienced by the patient him/herself, or accounts of a friend or a relative are also factors that increase the possibility of nausea [8].

After the initial stimulus, nausea is mediated by a number of cranial centers. The vomiting center is located in the medulla oblongata and is closely related to vasomotor, respiratory, salivary, and vestibular centers [2]. The motor response of nausea is the movement of gastric contents and pharynx, produced by the trigeminal, facial, glossopharyngeal, vagus, accessory, and hypoglossal nerves (pairs V, VII, IX, X, XI, and XII, respectively), with major involvement of the parasympathetic and sympathetic systems [5], mainly the parasympathetic system [9].

Several strategies have been used in an attempt to control the gag reflex (antiemetics, tranquilizers, relaxation, distraction and desensitization, psychological therapies, local or general anesthesia, conscious sedation, hypnotis, and acupuncture) [1]. Acupuncture is a therapeutic technique derived from traditional Chinese medicine (TCM), which is defined as the insertion of solid needles into specific parts of the body (acupoints) for disease prevention, therapy, or health maintenance [10]. Acupuncture is able to correct the energy imbalances that occur in the meridians [11].

According to TCM, nausea and vomiting are explained as an upward Qi (energy) of the stomach in rebellion, and the acupuncture point PC6 (Neiguan) has the effect of subduing the rebellious energy of the stomach [12] by redirecting the Qi counterflow [13]. From the viewpoint of TCM, the nervous system is the means by which energy triggers a biochemical or biological effect, and thus it has a mixed structure (energophysical). The pericardium meridian, where acupoint PC6 is located, can be compared, in Western medicine, with the function of the parasympathetic autonomic system, which plays a regulatory role in the metabolic and conservative actions of organs [14].

The aim of this study was to evaluate the effectiveness of acupuncture point PC6 in controlling the gag reflex during intraoral impression taking.

2. Materials and methods

This was a controlled, double-blind clinical study, in which the researchers and the volunteer patients were not aware of the group to which the volunteers belonged. The study was conducted at the Piracicaba Dental School (FOP-UNICAMP) in Piracicaba (São Paulo, Brazil), from February 2013 to August 2013, in accordance with the standards required by the Declaration of Helsinki, and was approved by the Ethics Committee on Research of the FOP-UNICAMP (116/2012). The inclusion criteria were as follows: volunteer patients, adults of both sexes, aged 18–85 years, and who reported previous unpleasant nausea during dental procedures that hindered or prevented the dental treatment from being carried out properly. Pregnant patients and patients who had been taking antiemetic drugs or medications that could produce nausea were excluded from the study. Initially, 47 patients were invited to participate in the study, of whom 14 refused to participate (2 for fear of needles, 2 because of illness, 1 because she was wearing braces, 4 to avoid the feeling of nausea, and 5 due to lack of interest). The final sample consisted of 33 patients, aged 19–62 years, who were randomly assigned to two groups (treatment and control). The participants were submitted to a single session of treatment, approximately 40 minutes, in which two maxillary impressions (or attempts to take them) were performed; the first one was performed prior to acupuncture and the second after acupuncture. The study group (n = 17) was treated with real acupuncture needle penetration, and the control group (n = 16) with a placebo treatment, “sham nonpenetrating acupuncture.” All volunteers who participated in the study signed a term of free and informed consent. They were instructed not to eat within 2 hours prior to the appointment and were informed that they would not be aware of the group to which they would be assigned to. By means of a questionnaire, the following data about the patients were collected: personal and demographic data, whether or not they were knowledgeable about acupuncture, whether they had previously undergone any acupuncture treatment, whether they were under medication, how long they had suffered from nausea, and their expectation as regards the treatment. Two
professionals participated in the research; one (the volunteer researcher) inserted the acupuncture needles and the other (the main researcher) performed the impression-taking procedures and nausea assessment.

2.1. Description of points

The acupuncture point PC6 has antiemetic and anxiolytic properties, and one of its main indications is for harmonizing the Qi (energy) of the stomach [13,15]. It is situated in the pericardium meridian and located 2 Cun proximal to the wrist, between the flexor carpi radialis and the palmaris longus tendons. A Cun is a unit of TCM measurement; 1 Cun is equal to the breadth of the patient’s thumb [12]. It can be found with the measure equivalent to the breadth of three fingers on the anterior surface of the wrist, above the distal skin crease on the wrist joint where the median nerve passes [16–18].

2.2. Application of acupuncture

In both groups, acupuncture needles (real or sham) were inserted, prior to the second impression taking, at point PC6, unilaterally, in the right arm with a perpendicular insertion angle. The needle remained in place during the procedure (approximately 20 minutes) and was removed prior to discharging the patient. The procedure was performed in all participants by the same experienced and licensed acupuncturist (the volunteer researcher).

The disposable acupuncture needles used in the experiments (0.25 mm × 30 mm in size; Qizhou brand; Wujian City Shenli Medical & Health Material Co. Ltd, Wujian, Suzhou, Jiangsu, China) were individually packaged. In the test group, after disinfection of the skin with 70% alcohol at the site of needle penetration (this procedure was carried out in the control group also), a sterile disposable acupuncture needle was inserted. Considering the anatomical differences, the depth of needle penetration ranged from 0.5 cm to 1.0 cm, and it was manipulated clockwise and anticlockwise for 1 minute until "Deqi" was obtained [19].

In the control group, acupuncture was simulated with a sham needle (Asia-Med brand; Pullach, Munich, Germany), measuring 0.30 mm × 30 mm. This needle is retractable and has a blunt tip; therefore, it does not penetrate the skin. When it touches the skin, the patient feels a pricking sensation, simulating the puncturing of the skin [20]. To fix the sham needle in an acupuncture point, we used an intermediate circular device (ring), 1 cm in diameter and made of resin. This device was attached to the skin by means of hypoallergenic micropore tape (Nexcare; Suma_rê, São Paulo, Brazil), 0.12 cm wide. This type of acupuncture is best referred to, or better described, as "nonpenetrating sham" or "noninvasive sham" [21]. In the control group, the same stimulation procedure as that used in the study group was used, because the sham needle can produce it.

So that neither the researchers nor the patients were able to differentiate between the real acupuncture and the sham acupuncture, we used the resin ring in both groups, and the patient was covered with a disposable blue sheet of 40 grammage thickness until the end of the procedure. The angle of needle insertion was perpendicular.

2.3. Dental impression taking

The impression-taking procedures were performed in all the patients by the same professional (the main researcher). For molding, stainless-steel trays (Tecnodent brand), Várzea de Baixo São Paulo – SP – Brazil were used. These were sterilized and filled with regular setting alginate (Jeltrat Dustless; Dentsply, Petrópolis, Rio de Janeiro, Brazil). The alginate was manipulated in accordance with the manufacturer’s instructions.

2.4. Nausea assessment

Nausea was assessed by both the patient and the investigator.

Assessment by the researcher was undertaken, according to the Gagging Severity Index (GSI) that evaluated the severity of nausea and the Gagging Prevention Index (GPI) that evaluated treatment effectiveness in controlling nausea, in three stages of the impression taking: (1) when the empty impression tray was tried in the mouth; (2) when the loaded tray was inserted into the mouth; and (3) the tolerance of the tray in the mouth until the alginate set. The GSI and GPI were proposed in the study by Fiske and Dickinson [22]. The GSI index, which ranges from I (very mild gag reflex and controlled by the patient) to V (very severe gag reflex, making it impossible to perform the treatment), was assessed prior to acupuncture. The GPI index, which ranges from I (controlled gag reflex, successful treatment) to V (severe gag reflex, no treatment could be performed), was assessed after acupuncture [22].

Patients evaluated nausea using a visual analog scale (VAS), which consisted of a horizontal line 10 inches long, with word anchors at both ends; the patient made a mark at a point on this scale to represent the magnitude of his/her nausea, and a ruler was used to quantify the measurement [23]. In our study, we used the words "without nausea" at one end and "maximum nausea" at the other end. The VAS score was recorded on two occasions, at the end of the first molding without acupuncture (initial VAS) and at the end of the second impression with acupuncture (final VAS), in both groups.

2.5. Deqi and adverse effects

Patients reported the type of Deqi sensation that they felt by answering the following question: "Did you feel any sensation at the site of needling? If so, what did you feel?"

They also reported the adverse effects of acupuncture by answering the following question: "Did you feel any adverse effects after acupuncture? If so, what did you feel?"

2.6. Evaluation of expectation

To evaluate the volunteers’ expectation that nausea would be reduced by treatment with acupuncture, they were asked the following question at the beginning: "Do you believe acupuncture can solve your nausea problem?" The patient reported his/her answer using a Likert five-point scale with the following options: no, I do not think so; maybe; I think so, Yes.
2.7. Statistical analysis

To evaluate the reduction of nausea according to the GSI/GPI in the three stages and according to initial/final VAS, the t test was used.

To assess the influence of patients’ expectations of reduced nausea, the Spearman correlation coefficient was used.

A p value < 0.05 was considered statistically significant.

3. Results

The test and control groups were similar with respect to age, sex, ethnicity, duration of nausea, and expectation of treatment. The mean age of the participants was 42.4 years (standard deviation, SD = 13.77); the percentages of women and white adults were higher in both groups. The average time of duration of experiencing nausea was 15.5 years (SD = 12.08; Table 1).

When nausea was assessed by VAS (Table 2), it decreased in the real acupuncture (p = 0.015) and in the sham group (p = 0.010), however without statistically significant differences when comparing the two groups (p > 0.05). Nevertheless, when assessed by GSI and GPI, reduction in nausea differed statistically in the three evaluation stages of the molding process in the real acupuncture group. Prior to acupuncture, the median GSI values at the three stages were 2, 3, and 4 (mean values 1.7059, 3.3529, and 3.8235, respectively), indicating a degree of nausea from mild to severe, limiting the impression taking and making it impossible. After acupuncture, median GPI values were 1, 2, and 3 (mean 1.1765, 2.2941, and 2.5882, respectively), indicating a degree of nausea from very mild to moderate, or partially controlled nausea. In the sham group, the reduction in nausea did not differ statistically at any of the three stages, with p > 0.05 (Table 3).

In the present study, no adverse effects were observed in the real acupuncture group. In the group of nonpenetrating sham acupuncture, one patient reported increased sweating.

In the real acupuncture group, all the volunteers felt a pricking sensation and 11 of them reported at least one of the possible sensations of Deqi. In the sham group, 13 volunteers also felt a pricking sensation; five of them also reported Deqi sensation, and only three said that they did not feel anything.

There was no correlation between the volunteers’ expectation and the final VAS score (p > 0.05) or the GPI (p > 0.05), in any of the three stages (Table 4).

4. Discussion

Most of the previous studies have considered the action of acupuncture in controlling nausea during the postoperative, postchemotherapy, and pregnancy periods [24]. There are few references in the scientific literature related to the field of dentistry; therefore, studies related to this field are needed. This study is important and innovative because it compares the antiemetic action of the same acupoint (PC6), between real acupuncture and sham nonpenetrating acupuncture.

This study showed that acupuncture point PC6 provided partial relief of nausea in the maxillary impression-taking procedure. The noncontrolled study by Rosted et al [1] demonstrated that the acupuncture point VC24 (Chengjiang), located on the chin, was also effective for the relief of nausea. From our point of view, the use of acupoint PC6 is more suitable because it is located in the arm and would,
A controlled study by Lu et al [17] demonstrated that acupuncture/acupressure at point PC6 was effective in reducing nausea, in comparison with a dummy point. In the present study, the action of the same acupoint PC6 was compared between real penetrating acupuncture and sham nonpenetrating acupuncture, and nausea was also reduced. Bai et al [19], in another study with magnetic resonance imaging, demonstrated that acupuncture in PC6 can selectively cause a hemodynamic response in the insula and cerebellar hypothalamus, and exert a modulatory effect on the vestibulocerebellum and in areas of autonomic regulation. These findings may support the notion of a sedative or tranquilizing effect, emphasizing the antiemetic action of PC6 and providing a path to elucidate the specificity of the effects of acupuncture. The study by Sari and Sari [10] concluded that VC24 and PC6 acupoints showed a synergistic effect in controlling nausea in patients undergoing orthodontic treatment.

In this study, when nausea was assessed by the GSI/GPI, the percentage reduction in nausea in the group treated with real acupuncture, in the three stages of evaluation, was approximately 32%. One should consider the fact that when a patient with a severe degree of nausea starts gagging, he/she tends to believe that he/she cannot interrupt it until the stimulus is removed [1]. Thus, we can infer that during normal clinical care, i.e., outside of a research situation, the result of acupuncture may be even better, because acupuncture is performed before the gag reflex or its potentialization is induced.

When nausea was evaluated by VAS, it was found that the reduction in nausea was similar in both groups. Therefore, the GSI and GPI were more capable of assessing the control of nausea than VAS. It is supposed that this is due to the fact that GSI and GPI were assessed in three stages of the impression-taking procedure, while the VAS assessment was performed only at the end of the procedure. Had the VAS assessment also been performed in the three stages, significant differences would have been found between the groups. Another possible explanation for the reduction in nausea in both groups when assessed by VAS is that VAS is a self-rated measure. Thus, the positive effect in the sham group may be that VAS is a self-assessment scale and could therefore have a greater placebo effect than other objective measures. There are some data to suggest that placebo effects are greater for psychological and self-rated measures than for other objective measures [25]. We emphasize that this placebo effect should have occurred in both groups.

The placebo effect of acupuncture was also observed in this study, as one patient treated with acupuncture and having the maximum degree of nausea (GSI = 5 and initial VAS score = 10) had a 100% reduction in nausea (GPI = 1 and final VAS score = 0). It is noteworthy that this patient had previous knowledge about acupuncture. There is the hypothesis that cognitive (expectations and beliefs), sensory, and emotional factors act simultaneously in the placebo response [17].

In this study, in the real acupuncture group, there were no reports of adverse effects, similar to the findings of the study by Grillo et al [26]; however, the literature reports that mild and transient adverse effects may occur in approximately 7–11% of cases treated with acupuncture [27]. In the group of nonpenetrating sham acupuncture, only one patient reported increased sweating; however, this patient had declared having a fear of needles, which justifies the reported effect. One of the advantages of acupuncture is that the occurrence of adverse effects is significantly lower than that with many drugs and therapeutic procedures used for the same conditions [11].

Most acupuncturists consider the Deqi phenomenon to be crucial in achieving the effect of acupuncture [13,28]. When an acupoint is stimulated by insertion of a needle, the patient may experience a particular sensation called Deqi, which presents as pain, numbness, heat, weight, or distention around the area where the needle is inserted. Sometimes this feeling radiates along the path of the

<table>
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<tr>
<th>Table 3</th>
<th>GSI/GPI scores in the groups: mean values (range), p, and percentage of improvement (Piracicaba, 2013).</th>
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<tr>
<td>Stage</td>
<td>Real acupuncture (n = 17)</td>
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<tr>
<td></td>
<td>Mean (I)</td>
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<tr>
<td>GSI (prior to acupuncture)</td>
<td>1.7059</td>
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<tr>
<td>GPI (after acupuncture)</td>
<td>1.1765</td>
</tr>
<tr>
<td>p</td>
<td>0.0077</td>
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<td>% Improvement</td>
<td>31.0334</td>
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</tbody>
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GSI = Gagging Severity Index; GPI = Gagging Prevention Index; Stage I = empty tray; Stage II = loaded alginate tray; Stage III = able to tolerate the tray until alginate set.

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<th>Table 4</th>
<th>Correlation scores between expectation with GPI and with final VAS, in the groups (Piracicaba, 2013).</th>
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<tr>
<td></td>
<td>Real acupuncture (n = 17)</td>
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<tr>
<td>r</td>
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<tr>
<td>GPI Stage I</td>
<td>0.0773</td>
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<tr>
<td>GPI Stage II</td>
<td>0.0087</td>
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<tr>
<td>GPI Stage III</td>
<td>–0.0033</td>
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<tr>
<td>VAS</td>
<td>–0.0413</td>
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GPI = Gagging Prevention Index; Stage I = empty tray; Stage II = loaded alginate tray; Stage III = able to tolerate the tray until alginate set; VAS = visual analog scale.
meridian to which the point belongs [28]. This sensation may also be a mild electric shock [17]. In the present study, the Deqi sensation occurred more often in the real acupuncture group, although some patients in this group reported only a pricking sensation, probably because it overlapped another possible Deqi sensation. By contrast, some volunteers in the sham acupuncture group reported a Deqi sensation. As regards Deqi with the placebo needle, this might have been caused by the pressure of the resin ring and fixing adhesive, by psychological influences, or by direct pressure on pain receptors in the skin [20].

The volunteers’ expectations had no correlation with GPI at any stage of the evaluation of the groups with real or sham acupuncture (p > 0.05). There was also no correlation between expectations and final VAS scores in either group, in spite of complete remission of reflex nausea in one patient in the sham group, who had highly positive expectancies. There are relatively few studies testing the relationship between patient expectancy and acupuncture outcomes, there are some inconsistencies between studies [29].

One limitation of this study was that it was conducted only taking impressions of the maxillary arch, although some patients reported having more pronounced nausea during mandibular impression taking. Another limitation was that VAS assessment was carried out only at the end of the procedure.

5. Conclusion

This study demonstrated that acupuncture point PC6 was effective in controlling nausea in maxillary impression taking. The volunteers’ expectations had no influence on reducing nausea.

Disclosure statement

The author affirms there are no conflicts of interest and the author has no financial interest related to the material of this manuscript.

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