

## IN BRIEF

- Acupuncture can be timesaving in patients with severe gag reflex.
- Acupuncture has a nearly instant effect in controlling the gag reflex in eight out of ten patients.
- Acupuncture can reduce the discomfort for patients suffering from a severe gag reflex during dental treatment.

# The use of acupuncture in controlling the gag reflex in patients requiring an upper alginate impression: an audit

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**Background** A pronounced gag reflex (GR) can be a problem to both the acceptance and delivery of dental treatment. Despite a range of management strategies, some patients cannot accept even simple dental treatment. The aim of this study was to evaluate the use of acupuncture point CV-24 in controlling a profound gag reflex during dental treatment requiring an upper alginate impression.

**Method** Members of the British Dental Acupuncture Society were invited to take part in an audit of the role of acupuncture point CV-24 in controlling the gag reflex. They were issued with patient inclusion criteria, a standardised procedure instruction sheet and a recording form. All patients fulfilling the inclusion criteria had an upper dental alginate impression taken (or an attempt made at it) before acupuncture, and a second upper alginate impression taken immediately after acupuncture of point CV-24. The GR assessment was undertaken prior to insertion of the acupuncture needle using the Gagging Severity Index (GSI); and after the acupuncture and impression taking using the Gagging Prevention Index (GPI). Both the GSI and GPI were recorded at three stages of the dental impression taking procedure, ie, when the empty impression tray was tried in the mouth, when the loaded tray was inserted into the mouth, and on completion of the impression taking.

**Results** Twenty-one dentists submitted 64 case reports of which 37 fulfilled the inclusion criteria. Prior to acupuncture all 37 patients (20 females and 17 males with a mean age of 46.8 years) were unable to accept the impression taking. After acupuncture of point CV-24, an improvement of between 51-55% (mean 53%) for the three stages

of impression taking was noticed. Thirty patients (81%) were able to accept the impression taking, whereas seven (19%) remained unable to tolerate the procedure. Assessed by the GSI and GPI, there was a significant decrease in GR scores at all three stages of the impression taking procedure (median 3 vs 1; 4 vs 2; 4 vs 2;  $p < 0.0001$ ). Thus before acupuncture, the patients had moderate to severe GR and after acupuncture the GR had reduced to a level which only complicated dental treatment slightly.

**Conclusion** Our results indicate that acupuncture of point CV-24 is an effective method of controlling severe GR during dental treatment including impression taking. However, the results of the current audit need to be tested in a randomised controlled study in order to substantiate the effectiveness of this method.

## INTRODUCTION

The gag reflex (GR) is considered a normal, protective, physiological mechanism that occurs in order to prevent foreign objects or noxious material from entering the pharynx, larynx or trachea.<sup>1</sup> A proportion of the population has a profound and exaggerated reflex that can cause acute limitation of the patient's ability to accept dental treatment and the clinician's ability to provide it. The exact prevalence of the problem in relation to dental treatment is unknown.<sup>2</sup> The origin of gagging has been categorised as either *somatic* (initiated by sensory nerve stimulation from direct contact) or *psychogenic* (modulated by higher centres in the brain). In somatic gagging, touching a trigger area induces the reflex. Although trigger areas are specific to individuals, sites such as the lateral border of the tongue and certain parts of the palate commonly elicit the GR.<sup>1</sup> Psychogenic gagging can be induced without direct contact and the sight, sound, smell or even the thought of dental treatment can be sufficient to induce the gag reflex in some individuals.<sup>1</sup> An unambiguous division between a somatic and a psychogenic gag reflex is not possible. Thus, some patients, who demonstrate a severe somatically induced gag reflex at the dentist, are able to brush their teeth, eat, and place other objects in their own mouth without problems. Other factors

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Table 1 Gagging Severity Index (GSI)

Severity grading	Description
Grade I Normal gagging reflex	Very occasional gagging occurs during high-risk dental procedures such as maxillary impression taking or restoration to the distal, palatal or lingual surfaces of molar teeth. This is basically a 'normal' gag reflex under difficult treatment circumstances. Generally controlled by the patient.
Grade II Mild gagging	Gagging occurs occasionally during routine dental procedures such as fillings, scaling and impressions. <b>Control can usually be regained by the patient</b> , although they may need assistance and reassurance from members of the dental team, and treatment continued. No special measures are generally needed to facilitate routine treatment but may be required for more difficult procedures.
Grade III Moderate gagging	Gagging occurs routinely during normal dental procedures. This may include simple physical examination of high-risk areas, such as the lingual aspect of lower molars. Once instigated, control is difficult to regain without cessation of the procedure. Re-commencement may be difficult. <b>Gagging prevention measures are usually required.</b> The gag may influence treatment planning and may limit treatment options.
Grade IV Severe gagging	<b>Gagging occurs with all forms of dental treatment including simple visual examination.</b> Routine treatment is impossible without some form of special measure to attempt to control the gag reflex. Treatment options may be limited and the gagging problem will be a major factor in treatment planning.
Grade V Very severe gagging	Gagging occurs easily and may not necessarily require physical intervention to trigger the reflex. <b>The patient's behaviour and dental attendance may be governed by the gagging problem and it will be one of the prime factors when planning treatment.</b> Treatment options may be severely limited. Dental treatment will be impossible to carry out without specific, special treatment for control of the gagging problem.

such as nasal obstruction, gastrointestinal disorders, heavy smoking, ill-fitting partial or full dentures, variation in the anatomy of the soft palate, and previous unpleasant experience during dental treatment may indirectly contribute to the exaggerated gag reflex.<sup>3</sup> Ramsay *et al.*<sup>4</sup> suggest that bad dental experiences result in patients expecting, either consciously or subconsciously, to gag during future similar episodes.

A number of strategies have been used in an effort to control the profound gag reflex and allow the provision and acceptance of dental care. They include relaxation, distraction, and desensitisation techniques; psychological and behavioural therapies; local anaesthesia, conscious sedation and general anaesthesia techniques; and complementary medicine therapies such as hypnosis and acupuncture.<sup>5,6</sup> These strategies have all met with varied success and it may be necessary to try a number (and in some cases all) of them to find the appropriate technique for an individual.<sup>5,6</sup>

Acupuncture has been used successfully to control the gag reflex. In a controlled study by Lu,<sup>7</sup> it was established that acupuncture of point *Pericardium 6 (PC-6)*, located on the forearm, had a significant effect on the reduction of the gag reflex. In an uncontrolled study by Fiske and Dickinson in 2001,<sup>3</sup> it was demonstrated that ear acupuncture was able to control the severe gag reflex of 10 patients sufficiently well to allow dental treatment to be carried out. Finally, in 2003, Rösler *et al.*<sup>8</sup> showed in a controlled study that acupuncture at *Conception Vessel 24 (CV-24)*, located on the chin, could control the gag reflex in patients having transoesophageal echocardiography.

The aim of this study was to test if acupuncture of acupuncture point CV-24 was able to control the gag reflex in patients requiring an upper alginate impression.

## MATERIALS AND METHODS

### Subjects and procedure

All members of the British Dental Acupuncture Society working in general dental practice were invited to take part in an audit of the role of acupuncture point CV-24 in controlling the

gag reflex. All participating dentists were issued with patient inclusion criteria, a standardised procedure instruction sheet and a recording form. As the treatment was a supplement to the dentists' standard treatment for controlling the gag reflex and no placebo procedures was involved, a telephone enquiry to the local ethics committee revealed that ethics approval was unnecessary. Patients who on previous occasions had demonstrated difficulties in accepting impression taking due to a severe gag reflex, were offered acupuncture treatment as a supplement to the dentists' standard procedure for controlling the gag reflex. Three children were included among the patients and the parents' consent was achieved in all cases. The patient inclusion criteria included the following:

1. Inability to accept dental treatment on a previous occasion due to a severe gag reflex
2. Current dental treatment requires an upper alginate impression to be taken
3. The individual is able to give informed consent.

Twenty-one dentists submitted 64 case reports. Twenty-seven reports were excluded as they were either incomplete or patients did not fulfil the study inclusion criteria. Twenty-three reports concerned bite wings and four reports were incorrectly filled in. The remaining 37 reports form the basis of this audit. In order to ensure a homogenous patient group, only patients who on previous occasions were unable to accept an upper dental alginate impression were included in this study. The 37 patients comprised 20 females and 17 males. The mean age was 46.8 years (standard deviation, SD = 18.3; range 10-90 years). Two of the female patients were 12 years and another one 10 years of age.

The procedure involved each patient having an upper dental alginate impression taken (or an attempt made at it being taken) before acupuncture and a second upper alginate dental impression taken (or an attempt made at it being taken) after acupuncture. The acupuncture involved insertion of a single, disposable acupuncture needle into acupuncture point

CV-24 (Fig. 1). The needle was inserted 0.3-0.5 mm and rotated clockwise and anticlockwise for five seconds. Thereafter, the impression tray was inserted in the patient's mouth and the dentist continued the procedure. The needle was left *in situ* throughout taking of the second upper alginate impression and removed on its completion.

#### Assessment of gagging severity

The GR assessment was undertaken prior to insertion of the acupuncture needle using the Gagging Severity Index (GSI), which assesses the magnitude of the gag reflex, and after the acupuncture and dental impression taking using the Gagging Prevention Index (GPI), which assess the effectiveness of the treatment, as described by Dickinson.<sup>2</sup> Both indices are based on a descriptive scale related to the severity of the gag reflex and the ability to carry out dental treatment. They are ranked on a scale from I (mild GR) to V (severe GR) (Tables 1 and 2). Both the GSI and GPI were recorded at three stages of the impression taking procedure: 1) when the empty impression tray was tried in the mouth; 2) when the loaded tray was inserted into the mouth; and 3) on completion of the impression taking (Tables 1 and 2). All results were recorded onto the audit recording form. To the best of our knowledge this is the only scale which assesses the magnitude of the GR and the effectiveness of a given treatment.

#### Statistical analysis

The Wilcoxon signed rank test was used in order to compare the GSI and GPI scores before and after the acupuncture treatment. Spearman rank correlation was applied to assess associations between GSI and GPI scores, the patients' age and duration of gagging problems. P-values of < 0.05 were considered statistically significant.

#### RESULTS

In the study group, the mean age of the 20 female patients was 45.2 years (SD = 21.2; range 10-90 years) and of the 17 male

patients 48.9 years (SD = 14.6; range 25-70 years). Within the whole study group, the mean duration of the gagging problem was 27.2 years (SD = 18.7; range 2-60 years). Among the female and male patients, the mean duration of the gagging problem was 24.7 (SD = 18.5; range 2-60) and 29.4 years (SD = 19.0; range 4-60), respectively. There was no statistical significant difference between females and males with regard to age and duration of the gagging problem. Age and duration of the gagging problem was significantly correlated in the study group as a whole ( $r = 0.74$ ,  $p = 0.0001$ ) as well as in the female group ( $r = 0.80$ ,  $p = 0.0003$ ) and the male group of patients ( $r = 0.67$ ,  $p = 0.003$ ).

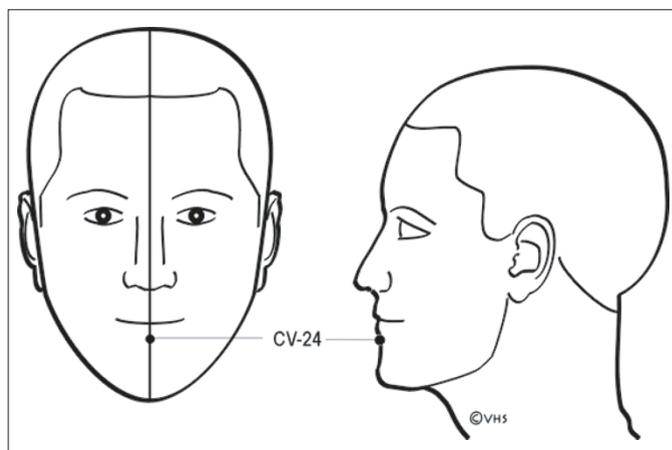
Prior to acupuncture all 37 patients were unable to accept an upper alginate impression taking. After acupuncture of point CV-24, 30 patients (81%) were able to accept the impression taking. Seven patients (19%) remained unable to tolerate the procedure. Before acupuncture the median GSI values of the 37 patients in the three stages of the impression taking procedure (ie, when the empty impression tray was tried in the mouth, when the loaded tray was inserted into the mouth, and on completion of the impression taking) were 3, 4 and 4 (mean values 2.9, 3.8 and 4.1 respectively with total mean of 3.6), indicating a severe GR that limited dental examination and treatment and in some cases made it impossible. After acupuncture, the median GPI values were 1, 2 and 2 (range 1-5, mean values 1.4, 1.7 and 2.1, respectively with a total mean of 1.7) indicating a mild to moderate GR only, that enabled the examination, and in most cases treatment, to be carried out. The GSI scores (before acupuncture) and GPI scores (after acupuncture) for the 3 stages of impression taking are presented in Table 3. Overall they show an average improvement between the GSI and GPI scores of 53% before and after the use of acupuncture, and a significant difference before and after acupuncture in stages 1, 2 and 3 ( $p < 0.0001$ ). No side effects were observed for patients receiving acupuncture. Age was correlated to scores of GSI and GPI in stage 2 ( $r = 0.42$ ;  $p = 0.005$ ) and stage 3 ( $r = 0.35$ ,  $p = 0.03$ ), but not to scores in stage 1. Duration of the

Table 2 Gagging Prevention Index (GPI)

Prevention grading	Description
Grade I Gagging reflex obtunded	Very occasional gagging occurred during high-risk dental procedures such as maxillary impression taking or restoration to the distal, palatal or lingual surfaces of molar teeth. This is basically a 'normal' gag reflex under difficult treatment circumstances. Generally controlled by the patient.
Grade II Partial control	Partial control of the gag reflex. The proposed treatment was possible but occasional gagging occurred.
Grade III Partial control	Partial control of the gag reflex. <b>The proposed treatment was part completed or alternative treatment was carried out.</b> This involved simpler procedures at lower risk of producing gagging. Gagging occurred frequently.
Grade IV Inadequate control	Inadequate control of the gag reflex. The proposed treatment was not possible. <b>Some 'treatment' was carried out but only very simple procedures.</b> Gagging occurred regularly.
Grade V No control	Failure to control the gag reflex. <b>Gag reflex was so severe that even simple treatment was not possible.</b> No treatment was provided or possible using these gagging control methods.

**Table 3** The treatment related Gagging Severity and Gagging Prevention scores given in median and mean values and (range) for the whole group of patients (n = 37)

	GSI before acupuncture	GPI after acupuncture	P-value	Percentage improvement
Stage 1: on insertion of the empty impression tray	3 (1-5) mean 2.9	1 (1-3) mean 1.4	P < 0.0001	52%
Stage 2: on insertion of the loaded impression tray	4 (1-5) mean 3.8	2 (1-5) mean 1.7	P < 0.0001	55%
Stage 3: ability to keep the impression in the mouth until set	4 (1-5) mean 4.1	2 (1-5) mean 2.1	P < 0.0001	51%
Total mean scores	mean 3.6	mean 1.7	P < 0.0001	53%



**Fig. 1** Location of acupuncture point CV-24

gagging problem was also correlated to scores of GSI and GPI in stage 2 ( $r = 0.36$ ,  $p = 0.03$ ) and stage 3 ( $r = 0.31$ ,  $p = 0.05$ ), but not to scores in stage 1. There was no statistically significant difference between gender and scores of GSI and GPI.

## DISCUSSION

Gagging problems are not uncommon in a dental practice. Anecdotal evidence suggests that up to 87% of dentists are faced by patients who experience this problem at least once a month.<sup>9</sup> This can have a profound impact on planned and optimal dental treatment. The current audit shows that acupuncture of point CV-24 just before taking an upper alginate impression had a substantial controlling effect on the gag reflex. These findings mirror those of Rösler *et al.*,<sup>8</sup> who compared the effect of acupuncture given in CV-24 against superficial needling on the chin and an untreated control during a transoesophageal echocardiography. Rösler *et al.* reported a statistically significant effect ( $p = 0.037$ ) in the acupuncture group compared with the superficial needling group and the untreated control group. To our knowledge there are no other studies which specifically analyse the potential effect of

CV-24 in controlling the gag reflex. However, there are two other studies regarding the use of acupuncture in treating the gag reflex in relation to dental treatment, using another point combination or another technique.<sup>3,7</sup> In one case the point PC-6 (located on the forearm) was used.<sup>7</sup> Patients were randomly allocated to either acupuncture at PC-6 or acupressure at the same point. In the acupuncture group, needles were inserted in PC-6 and in a nearby non-acupuncture point, and stimulated electrically. Both techniques resulted in control of the gag reflex, with a greater effect being found in the acupuncture group. In the other case, ear acupuncture was used for a case-reported series of 10 patients where dental treatment was impossible due to a severe gag reflex. In eight out of ten cases it was possible to control the gag reflex completely and the reflex was partly controlled in the remaining two cases.<sup>3</sup>

Whilst acupuncture can have a placebo effect, the positive results of the current study and of the reported literature outweigh those that would be expected by a placebo effect alone. In the current study, the taking of the first impression without acupuncture has already activated the gag reflex. Once individuals with a profound GR have started gagging they tend to believe they cannot stop until the trigger is removed, making it less likely that the acupuncture, for the second impression, acts via a placebo effect. This statement is supported by Ramsay *et al.*<sup>4</sup> who suggested that bad dental experiences (gagging during GSI) results in patients expecting, either consciously or subconsciously, to gag during future similar episodes.

The mode of action in controlling the gag reflex through acupuncture is not fully understood. It covers the spectrum of the gag reflex from the mild end of nausea, where the threshold for gagging has not been exceeded, to the severe end that culminates in vomiting, where the threshold has been exceeded. In relation to dental treatment, including impression taking, the gag reflex is triggered either by a direct contact with trigger zones such as the tongue or the palate; or by psychogenic factors. The gag reflex is assumed to be controlled from the vomiting centre. More recent studies indicate that multiple brain stem sites mediate the act of vomiting (or emesis) and that no isolated centre exists.<sup>10,11</sup> The sites comprise groups of neurons that are spread throughout the medulla oblongata and the hindbrain.<sup>10</sup> The neurons are believed to be activated by a central pattern generator which coordinates the sequence of various autonomic neural changes that are associated with vomiting.<sup>10,11</sup> Thus the hindbrain neurocircuitry of neurons controlling vomiting is closely linked to nuclei within the brain stem controlling vasomotor, respiratory, salivary, vestibular and cardiac activity. The neurons receive impulses *via* the auricular (VIII), glossopharyngeal (IX) and vagal (X) cranial nerves from the internal ear, the pharynx, the tongue, the palate, the oesophagus and the stomach. Moreover, the neurons receive impulses (pain, vision, smell) from the cortex and chemoreceptor trigger zones in area postrema at the base of the 4<sup>th</sup> ventricle.<sup>11,12</sup> Efferent impulses from the neurons controlling behaviours associated with vomiting are transmitted *via* the vagal nerve, the spinal nerves and the phrenic nerves.<sup>11,12</sup>

The most likely cause of a somatically induced gag reflex during dental treatment is the activation of trigger zones in the posterior region of the oral cavity, which are innervated by the glossopharyngeal nerve (IX). Those patients who react with a severe gag reflex when a dental instrument touches the lips or

the anterior part of the oral cavity are probably expressing a psychogenically initiated response, as the mucous membrane in the anterior part of the oral cavity is innervated by the trigeminal nerve (V), which is not considered to take part in the gagging reflex.<sup>11,12</sup> However, there are close connections in the pons between the cranial nerves V, IX and X, and abnormal impulse transmission has been described between the vagal and the trigeminal nerves.<sup>13</sup>

It has been shown that acupuncture causes an increase in circulating  $\beta$ -endorphine<sup>14</sup> and accelerates the synthesis of serotonin and noradrenaline.<sup>15</sup> Opiates have both an emetic and an anti-emetic effect. The emetic effect is mediated via  $\delta$ -receptors and the anti-emetic effect is mediated *via*  $\mu$ -receptors. Beta-endorphine has an affinity to both types of receptors, whereas enkephalines mainly have an affinity to the  $\delta$ -receptors. It has been suggested that the anti-emetic effect of acupuncture is caused by the increased level of  $\beta$ -endorphine. Additionally, it has been suggested that acupuncture can desensitise chemoreceptor trigger zones in the brain *via* neurochemical substances and, thus, have an anti-emetic effect.<sup>16</sup>

Somri *et al.*<sup>16</sup> assessed the effect of acupuncture in points PC-6 and CV-13 (located over the sternum), ondansetron (an anti-emetic drug), and a placebo (the intravenous injection of saline) for post-operative nausea and vomiting. The treatment/placebo was given just after the patient was anaesthetised. Whilst a significant difference was found between the two treatment groups (acupuncture and ondansetron) and the placebo group ( $p < 0.0001$ ), no difference was demonstrated between the effects of acupuncture and ondansetron. Ondansetron is a serotonin antagonist, which influences the 5-HT<sub>3</sub> receptors, followed by an influence on the potassium (K<sup>+</sup>) channels.<sup>16</sup> It has been shown that serotonin (5-HT) causes an inhibition by activating post-synaptic 5-HT<sub>1</sub> receptors, causing an opening of the K<sup>+</sup> channels. However, other serotonin receptors may have the opposite effect on 5-HT resulting in an excitatory effect of the same neurons, and the opposite effect on the K<sup>+</sup> channels.<sup>13</sup> As acupuncture has a direct effect on the synthesis of serotonin and noradrenaline,<sup>15</sup> it is likely that acupuncture has a similar effect on the 5-HT<sub>3</sub> receptors as does ondansetron.

It has been shown that both acupuncture points PC-6 and CV-24 seem to have an effect on the gag reflex. The specificity of these two points needs to be investigated in a controlled study. However, the possible effect from both points can be explained. Stimulation of acupuncture point PC-6 activates the spinal segments C<sub>3</sub>-C<sub>6</sub> and impulses ascend, *via* the spinothalamic tract, to centres in the mid-brain, in particular the nucleus of the raphe magnus (nRm). These impulses are mediated *via* the A- $\delta$ -fibre. The point CV-24 is located on the chin between the orbicularis oris muscle and the mentalis muscle (Fig. 1). However, the innervation of this region is unclear as several anastomoses exist.<sup>17</sup> The sensory innervation is transmitted *via* the trigeminal nerve and the motor innervation is transmitted *via* the facial nerve, however, one cannot exclude the participation of fibres from the transversus colli nerve. The trigeminal nerve belongs to the somatosensory system, transmitting impulses from mechanoreceptors, thermoreceptors and nociceptors in the face and part of the oral

mucous membrane, and terminating in the trigeminal nucleus. These impulses are probably transmitted *via* the A- $\delta$ -fibres. The function of the trigeminal nucleus can be compared to that of the dorsal horn of the spinal column. Thus, fibres from the trigeminal nucleus continue, like the peripheral nervous system, *via* the spinothalamic tract to centres in the brain, including the nRm.<sup>13</sup> The nucleus of the raphe magnus is the main producer of 5-HT in the brain,<sup>18</sup> which is metabolised to, among others,  $\beta$ -endorphine, which may have an anti-emetic effect.<sup>16</sup> It has been shown that acupuncture accelerates the synthesis of 5-HT,<sup>15</sup> and it is likely that the serotonin mechanism takes part in control of the gagging reflex. However, it is unclear whether the gagging reflex is blocked by  $\mu$ -receptors due to a release of  $\beta$ -endorphine or a presynaptic inhibition of 5-HT receptors or a combination of both mechanisms. On the other hand, other receptors such as dopamine and histamine may also play a role.

## CONCLUSION

The current audit demonstrated that acupuncture of point CV-24 can moderate the gag reflex in the majority of patients previously unable to accept an upper alginate impression, and sufficiently well to allow dental treatment to be carried out. It would seem to be an effective method of controlling the gag reflex. However, a randomised controlled study is needed to substantiate our present results. Several questions are still open, such as the duration of the effect, the specificity of the points CV-24 and PC-6, if one point is superior to the other and finally, if the two points have a synergistic effect.

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