

# A Review of Gagging Problems in Dentistry: I. Aetiology and Classification

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**Abstract:** Some people have a pronounced gag reflex that can be a severe limitation to their ability to accept dental care and the clinician's ability to provide it. It can compromise all aspects of dentistry, from diagnostic procedures to active treatment and can be distressing for all concerned. Many techniques have been described that attempt to overcome the problem. Dentists will undoubtedly see patients with gagging problems and knowledge of a variety of management strategies is necessary to aid the delivery of dental care.

This first paper looks at the background to gagging problems and their classification and categorization prior to clinical treatment. The second article will look at the clinical assessment of the patient presenting for dental treatment with a history of gagging problems. It will also review methods used to manage patients with gagging reflexes during dental treatment.

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**Clinical Relevance:** Knowledge of the aetiologies, classification and different treatment methods available will allow clinicians to manage people with gagging reflexes in general practice.

Gagging is a normal, protective reflex. Some people have a reduced or absent reflex, whilst others have a pronounced one. Pronounced gag reflexes can compromise all aspects of dentistry, from the diagnostic procedures of examination and radiography to any form of active treatment. In some patients with marked gagging reflexes, it can lead to avoidance of treatment. Many techniques have been described in attempting to overcome the problem. Unfortunately, few of them have a research evidence base.

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## DEFINITIONS OF GAGGING

The terms gagging and retching are often used synonymously. However, the terms have separate meanings. Retching is best viewed as the initial process of attempting to eliminate noxious substances from the stomach. Whereas, gagging is a protective reflex to stop unwanted entry to the mouth and oropharynx. Definitions of gagging appear to fall into two main categories. One group simply describes the anatomical mechanisms of the reflex and may or may not include the neural pathways involved. The other group of definitions describes the physiological reasoning behind the gagging reflex. Examples are:

- Gagging has been described as 'to *retch without actually vomiting*' and

*'involuntary spasmodic but ineffectual attempts to vomit'*.<sup>1</sup>

- The Oxford English Dictionary defines it as to *'make the motion of vomiting ineffectually and involuntarily'*.<sup>2</sup>
- Khan<sup>3</sup> describes gagging, also known as retching, as a normal protective reflex designed to protect the airway and remove irritant material from the upper gastro-intestinal tract and posterior oropharynx.
- Butterworth<sup>4</sup> defines retching as *'a strained or ineffective effort to vomit'*.
- Savage and MacGregor<sup>5</sup> state that *'retching or gagging is an ejective contraction of the muscles forming the pharyngeal sphincter'*.

A number of definitions separate gagging from actual vomiting but many clinicians treating patients with gagging problems will testify that the vomiting attempts are not always ineffectual! In reality, it is useful to view gagging as a precursor to vomiting. The patient may be valiantly attempting to control the problem, and not purposely vomit, but if the stimulus is overwhelming it may be beyond the patient's ability to control it. With this viewpoint it seems that definitions should include some focus on the patients' intention to prevent vomiting and control the intention, or progression, of gagging. Most definitions do not include the psychological and higher cranial centre involvement in gagging, even though many dental research articles focus on this aspect. A working definition of gagging is:

*Gagging is a stimulated, protective, reflex response to prevent material from entering the mouth or oropharynx. Gagging stimuli may be physical, auditory, visual, olfactory or psychologically mediated and the muscular contractions provoked may result in vomiting.*

## **ANATOMY AND PHYSIOLOGY OF THE GAG REFLEX AND THE INFLUENCE OF HIGHER CRANIAL CENTRES**

The normal, protective gag reflex is not present in everyone. In one study, 26% of young adults and 43% of elderly people failed to exhibit a gag reflex.<sup>6</sup> Whilst abnormal gag reflexes have been seen in some pathological conditions such as motor neurone disease and following head trauma,<sup>7,8</sup> there are no data giving the prevalence of gagging problems in the general population. After the initial stimulus, gagging is mediated in the brain by a number of cranial centres. The vomiting centre lies in the medulla oblongata and is closely linked to the vasomotor, respiratory, salivatory and vestibular centres. The trigeminal, glossopharyngeal and vagus nerves transmit tactile sensory impulses from receptors around the tongue, mouth and oro-pharynx to the brain. These stimuli may be modulated by impulses received from the olfactory, optic and auditory nerves and by the higher centres (through learned behaviours, emotions and memory). Efferent control of gagging and vomiting is relayed from the brain to the muscles of the oropharynx, tongue and upper gastro-intestinal tract via the trigeminal, facial, vagus and hypoglossal nerves and some spinal sympathetic nerves to the stomach and diaphragm. Under Whitehead and co-workers' categorization of psychosomatic illness, gagging would be designated as a condition influenced by external, environmental events that possess psychological significance.<sup>9</sup> That is, it can be learned or conditioned and have a profound effect upon behaviour. It can be mediated by cranial higher-centre control, which may be

subject to abnormal, learned processes or reactions to stressful events. This modulates the response adversely. Newton<sup>10</sup> felt that visual conditioning plays a large factor in 'psychosomatic' gagging as in some cases the sight of certain objects was enough to induce the reflex.

## **AETIOLOGY, CLASSIFICATION AND CATEGORIZATION OF GAGGING**

Gagging has been categorized as either 'psychogenic' or 'somatic' in origin.<sup>11</sup> This means that the initiation of the reflex is modulated by either the higher centres within the brain or by impulses from sensory nerves stimulated by direct contact. Touching a trigger area that is specific to the individual stimulates somatically induced gagging. Areas such as the posterior regions of the dorsum and lateral borders of the tongue, or certain parts of the palate, are common sites. 'Psychogenic' gagging can be induced without direct physical contact and, in its most severe form, the thought of dental intervention can be sufficient to induce gagging. Krol<sup>12</sup> used the terms 'psychogenic' and 'somatogenic', whereas Davis<sup>13</sup> used 'physiological' and 'psychological' with the same basic interpretations. Other 'influencing' factors have been described which are not necessarily direct inducers of gagging but increase the 'risk', and possibly the severity, in affected patients. Heavy smoking,<sup>14</sup> disorders of the gastro-intestinal tract<sup>15</sup> and incorrect occlusal vertical dimension of dentures<sup>16</sup> are examples of factors that have been implicated.

A single aetiological factor is a rather simplistic viewpoint and researchers discuss the multi-factorial nature of gagging.<sup>10</sup> Theoretically, 'somatic' gagging induced by, for example, a dental mirror placed in the mouth should be reproduced by other objects. However, many patients who gag at the dentist can eat, brush their teeth and place other objects in their own mouths with little or no consequence and it is evident that other factors are involved. Wright<sup>17</sup> found little difference in

'organic' variables, such as anatomical variations, oral (hyper) sensitivity and medical conditions/history, between 'retching' and 'non-retching' dental patients. Ramsay and others<sup>18</sup> postulated that the important factors are the past dental experiences and learned experience/response. Patients who have had a 'bad dental experience' in the past may expect, either consciously or sub-consciously, to gag during future similar events. It is only the severity of the response that distinguishes whether the patient actually gags when something is placed in the mouth or at just the thought of it.

Few attempts have been made to classify gagging. Krol's<sup>12</sup> divisions of gagging (1963) into somatogenic and psychogenic categories, by perceived aetiology/origin, is still used. In 1968, Faigenblum<sup>15</sup> categorized retching patients by severity of the problem. He simply divided prosthodontic patients' retching problems into 'mild' or 'severe'. Mild gagging was deemed to be controllable by the patient and related to the inability to accept certain prosthodontic treatments. As most researchers now view gagging as multi-factorial in nature, Krol's classification needs an intermediate category linking the other two. Faigenblum's classification is limited to prosthetic treatments only and does not take into account the vast numbers of patients that can cope with certain dental procedures and not others. Aetiology and severity classifications are used throughout dentistry, and many are very useful, but they may not help the clinician to treat the patient successfully. The categories are often subjective and open to interpretation. For example, if a patient is classified as having a severe gagging problem, no limits, reasons or background may be available for this severity grading. It does not provide information about which treatments resulted in retching, if any treatments have been successful in the past, and if this grading was the result of a single or several treatment episodes. A good classification should be universally acceptable, give the clinician a reproducible standard of a patient's particular condition and assist the clinician in providing treatment.

| Severity Grading                 | Description   |
|----------------------------------|---|
| Grade I<br>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<br>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> , but 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<br>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<br>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<br>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. |

**Table 1.** Gagging Severity Index. (Reference: Fiske J, Dickinson C. *The role of acupuncture in controlling the gagging reflex using a review of ten cases.* Br Dent J 2001; 190(11): 611–613.)

resorption of the maxillary alveolar bone causing a shift in the upper denture base and loss of retention (Figure 2). Mack<sup>20</sup> suggested that variations in soft palate anatomy might explain gagging in some denture wearers. Wright<sup>14</sup> examined a number of anatomical features cited as possible influences on retching (the term used in these papers). She looked at the difference between retching and non-retching patients who were matched using the following features:

- Posterior point of the soft palate;
- Angle of the soft palate;
- Posterior point of the tongue;
- Palatopharyngeal airway;
- Linguopharyngeal airway;
- Anterior position of the hyoid;
- Nasopharyngeal isthmus.

However, no statistically significant associations were shown in these oral, anatomical forms between retchers and non-retchers. Innate hypersensitivity, along with variations of the intra- and



**Figure 1.** Psychogenically mediated gagging severity index IV. This patient gags simply by placing a mirror behind the lower anterior teeth or in the cheek beside the lower premolar teeth.



**Figure 2.** Anatomical contributory factors to gagging. The combination of a fibrous and mobile upper ridge with two lower standing canines make this patient's upper denture very unstable and can induce gagging during function.

### Gagging Severity Index

The index, shown in Table 1, has been devised in an attempt to classify the severity of a patient's gagging problems. The index separates gagging problems into five grades of increasing severity and can be used to compare the treatment a patient requires to allow assessment of the level and type of gagging management techniques required. For example, the patient in Figure 1 has a psychogenically mediated gagging response. Even a mirror placed behind the lower incisors, not touching tongue or teeth, induces gagging. Instruments for any dental procedure evoke this response (Severity Grade IV).

### CONTRIBUTING FACTORS

A number of factors have been

researched that influence the gagging response to various stimuli. Many of them are clinical observations and statistical association has not been possible owing to the subjective nature of the data and limited sample sizes. Consequently, these associations must be viewed with caution but not dismissed outright as statistical 'proof' may never be possible in studies of this nature. The contributing factors can be categorized as anatomical, medical, psychological and dental/iatrogenic.

### ANATOMICAL FACTORS

The role of anatomical factors is described in a number of prosthetic dentistry textbooks and some research work. Watt and MacGregor<sup>19</sup> felt that gagging could be influenced by





**Figure 3.** Iatrogenic contributory factors to gagging. This lower denture wax up has a thick lingual extension that could induce gagging on insertion. Also note the reduced tongue space between the premolar and molar teeth due to poor tooth positioning.

extra-oral areas innervated by the 5th, 9th and 10th cranial nerves,<sup>21,22</sup> has been postulated as the defining difference between retchers and non-retchers.

### MEDICAL FACTORS

Nasal obstruction<sup>17</sup>, sinusitis<sup>23</sup>, post-nasal drip, chronic catarrh and congestion<sup>14</sup> have all been clinically cited in the aetiology of gagging, but not statistically proven owing to low sample sizes. Heavy smoking has been observed as a common factor in one group of gagging patients.<sup>14</sup> Gastric disorders such as peptic ulceration<sup>15</sup> and diaphragmatic hernia<sup>24</sup> have also been implicated. Retching has been described as a presenting feature of pancreatic carcinoma<sup>15</sup> and glosso-pharyngeal neoplasm.<sup>25</sup> Gagging has been observed in Gilles de Tourette syndrome and other neuropsychiatric and movement disorders.<sup>26</sup> Patients with motor neurone disease (MND) have been found to have more easily triggered palato-pharyngeal reflexes.<sup>7,27,28</sup> MND has been implicated in both pronounced gagging and the absence of gag reflexes.

### PSYCHOLOGICAL FACTORS

Influencing factors such as fear,<sup>29</sup> stress and phobia,<sup>29,30</sup> and alcoholism,<sup>31</sup> have all been investigated. Kramer and Brahm<sup>30</sup> found that, in some patients, the sights and sounds of clinical dentistry could trigger gagging.

Landa<sup>32</sup> felt that visual and olfactory stimuli were potent mediators of the emotional response that acted as a precursor to retching. Faigenblum<sup>15</sup> discussed the role of ‘apprehension’ in the build up to dental treatment and how it is mediated by negative past experiences, either real or imagined. Hyperventilation has been linked to dental anxiety, and Barsby<sup>33</sup> believes that many patients with gagging problems exhibit ‘idiopathic symptomatic hyperventilation’ that may be a precursor to anxiety-induced gagging. An increased level of neuroticism has been suggested as playing a role, but researchers have been unable to associate this with statistical confidence.<sup>34,35</sup> Wright<sup>34</sup> observed that subjects in her trial, who exhibited gagging, were generally more ‘neurotic’ than their matched controls but the observation did not reach statistical significance. However, Wright failed to show that retching patients had greater oral awareness than non-retching controls.<sup>14</sup> She suggested that, if a multi-factorial aetiology is believed, for gagging, then neurotic tendencies could still have influencing effects. Indeed, abnormal behaviours, including maladaptive gagging reflexes, have been observed in some eating disorders.<sup>36</sup>

### DENTAL/IATROGENIC FACTORS

Various denture design faults and characteristics have been suggested to explain retching in denture wearers. These include inadequate posterior palatal and peripheral seal, restricted tongue space, over-extension and/or excessive thickness of the posterior palatal border, loss of normal palatal contour, generalized poor retention or stability for any reason, incorrect occlusal planes, reduced or excessive freeway space and incorrect denture tooth positions (Figure 3).<sup>15,16,19,37,38</sup> Many of these factors compromise either tongue space or position.

Many clinicians will have experienced a patient gagging when manipulation of the oral tissues,

instruments, and equipment or water spray have touched, or accumulated in, sensitive areas causing an instant response. For example, suction tubes touching the pillars of the fauces or mouth mirrors touching the posterior dorsum of the tongue can cause gagging. This is iatrogenic gagging and not anatomical and occurs as a normal response to unwelcome stimuli.

### MANAGING PATIENTS WITH GAGGING PROBLEMS DURING DENTAL TREATMENT

The second article will focus on the strategies available to the clinician to allow treatment to be completed. It should be noted, however, that part of this process involves recording the successes or failures of previous treatment episodes. This allows the clinician to modify procedures or change strategies to cope with different treatment requirements. This may be necessary within the same treatment plan for a single patient or across a number of patients with similar gagging problems. Rarely can a single management strategy be applied to every patient and the management of profound gagging is no exception. To this end it is useful to have a system of recording success or failure of any gagging control methods utilized.

### EVALUATING SUCCESS OF TREATMENT

An ‘outcome classification’ or ‘success rating’ can be very useful to clinicians. One example of such a success rating is well known in dental sedation in the form of the Ellis classification. Ellis<sup>39</sup> used a 5-point grading system of intravenous sedation success. The variables assessed are head and limb movement, co-operation, restlessness and ability to perform dental procedures. Grade I relates to an ideal sedation ‘episode’ with no limb movement and a fully co-operative patient with no restlessness. Grade V is recorded if the variables are so severe that dental procedures are impossible

| Prevention Grading                 | Description   |
|------------------------------------|---|
| Grade I<br>Gagging reflex obtunded | Treatment and management methods employed at this visit totally obtund the gag reflex. <b>Proposed treatment was completely successful.</b>   |
| Grade II<br>Partial control        | Partial control of the gag reflex. <b>The proposed treatment was possible but occasional gagging occurred.</b>  |
| Grade III<br>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<br>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<br>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 2. Gagging Prevention Index.

to perform. This relates to an unsuccessful sedation treatment episode. The fact that the classification is 'episodic' is useful. Different treatment procedures may require changes in the sedation level and techniques used. Thus the Ellis classification also relates to dental treatment success as well as sedation success. It may be possible to gain all the signs of sedation but still be unable to perform adequate dental treatment. In this index, the sedation and dental treatment are linked, making it useful and flexible for the clinician. The following classification of gagging severity is suggested for practical use by clinicians. Table 2 shows the 'Gagging Prevention Index'. This index records the effectiveness of the management methods employed to control the gag reflex and links it to the complexity of the dental treatment.

### SUMMARY

Gagging can be induced by a variety of physical and psychological stimuli. Clinicians need to be aware of the factors that can induce and modulate

gag reflexes. Grading the severity of a patient's reflex will aid in diagnosis and future treatment planning.

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