



ISSN: 0975-833X

Available online at <http://www.journalcra.com>

International Journal of Current Research
Vol. 8, Issue, 12, pp.43069-43072, December, 2016

INTERNATIONAL JOURNAL
OF CURRENT RESEARCH

REVIEW ARTICLE

GAGGING: GIVE THE MESS A MISS! PART I - ETIOLOGY

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ARTICLE INFO

Article History:

Received 22nd September, 2016

Received in revised form

18th October, 2016

Accepted 14th November, 2016

Published online 30th December, 2016

Key words:

Gagging, Vomiting, Retching, Gag reflex.

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Citation: Shilpa Chawla Jamenis, 2016. "Gagging: give the mess a miss! part i - Etiology", *International Journal of Current Research*, 8, (12), 43069-43072.

ABSTRACT

Very often we come across patients who have an excessive gag reflex. Gagging in dental patients can lead to avoidance of dental treatment and hence hinder the patient care. It can compromise the treatment at every stage, starting from diagnosis to rendering active treatment to the patient. This series of articles will outline the etiology and management of gagging. A literature search of PubMed, Cochrane and Wiley using keywords like 'gagging', 'retching', 'dental' was performed and all the articles till date were included. Additional articles were selected from hand searches of the reference articles of the articles got by the electronic search. The language was restricted to English.

INTRODUCTION

Gag reflex is nothing but a physiological response which safeguards the airway from foreign bodies. But excessive gagging in dental patients is a barrier to optimal patient care (Malkoc *et al.*, 2013; Fiske and Dickinson, 2001). Orthodontic treatment in patients who gag becomes very difficult especially with removable appliances. From the intra oral examination to impression making to intra oral photographs to finally the appliance wear, a meticulous planning is required at each step. Some people have such a bad gag reflex that it makes brushing their teeth almost impossible. Gagging is more commonly seen in men than in women.

Gag Reflex

The gag reflex or pharyngeal reflex is a reflex contraction of the back of the throat, evoked by touching the roof of the mouth, the back of the tongue, the area around the tonsils, the uvula, and the back of the throat. It, along with other aero digestive reflexes such as reflexive pharyngeal swallowing, prevents something from entering the throat except as part of normal swallowing and helps prevent choking. (Medical Neuroscience First edition)

Reflex Arc

In a reflex arc, a series of physiological steps occur very rapidly to produce a reflex. Generally a sensory receptor

receives an environmental stimulus, in this case from objects reaching nerves in the back of the throat, and sends a message via an afferent nerve to the central nervous system (CNS). The CNS receives this message and sends an appropriate response via an efferent nerve (also known as a motor neuron) to effector cells located in the same initial area that can then carry out the appropriate response. (Davies *et al.*, 1995)

In the case of the pharyngeal reflex:

- The sensory limb is mediated predominantly by CN IX (glossopharyngeal nerve)
- The motor limb by CN X (vagus nerve).

The gag reflex involves a brisk and brief elevation of the soft palate and bilateral contraction of pharyngeal muscles evoked by touching the posterior pharyngeal wall. Touching the soft palate can lead to a similar reflex response. However, in that case, the sensory limb of the reflex is the CN V (trigeminal nerve). In very sensitive individuals, much more of the brain stem may be involved; a simple gag may enlarge to retching and vomiting in some. (Medical Neuroscience first edition)

Suppression and Activation

Swallowing unusually large objects or placing objects in the back of the mouth may cause the pharyngeal reflex. Some people, for instance sword swallows, have learned how to suppress it. (Fiske and Dickinson, 2001) In contrast, triggering the reflex is sometimes done intentionally to induce vomiting, for example by those who suffer from bulimia nervosa.

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According to one study, one in three people lacks a gag reflex. (Davies *et al.*, 1995) However, on the other end of the spectrum are people with a hypersensitive gag reflex. This hypersensitivity can lead to a variety of issues, from swallowing a pill or large bites of food to visiting the dentist. Hypersensitivity is generally a conditioned response, usually occurring following a previous experience. (Medical Neuroscience First edition)

Absence

In certain cases, absence of the gag reflex and pharyngeal sensation can be a symptom of a number of severe medical conditions, such as damage to the glossopharyngeal nerve, the vagus nerve, or brain death. In unilateral (one-sided) glossopharyngeal nerve (CN IX- sensory component) damage, there will be no gag response when touching the pharyngeal wall on the same side of the damaged nerve. With one-sided vagal nerve (CN X- motor component) damage, the soft palate will elevate and pull toward the intact side regardless of the side of the pharynx that is touched. This is because the sensory component is intact on both sides, but only the motor nerves supplying one side of the soft palatine and pharyngeal muscles is working; therefore the contraction of the muscles in the reflex is asymmetrical. If both CN IX and X are damaged on one side (not uncommon), stimulation of the normal side elicits only a unilateral response, with deviation of the soft palate to that side; no consensual response is seen. Touching the damaged side produces no response at all. At one point, it was thought that a lack of the gag reflex in stroke patients was a good predictor for dysphagia (difficulty with swallowing) or laryngeal aspiration (food or drink entering the larynx), and was therefore commonly checked for. However, in one study, 37% of healthy people did not have a gag reflex, *yet all* subjects except for one still retained an intact pharyngeal sensation. These results suggest that the muscles that control the gag reflex remain independent of those that control normal swallowing. Since this reflex is commonly not found in healthy people, its predictive value in determining the risk for swallowing disorders is severely limited. Pharyngeal sensation, on the other hand, as seen by this study, is rarely absent, and could prove better at predicting future problems with swallowing. (Medical Neuroscience First edition; Davies *et al.*, 1995)

Sequence of events in gagging

When stimulation occurs intraorally, afferent fibers of the trigeminal, glossopharyngeal, and vagus nerves pass to the medulla oblongata. (Bassi *et al.*, 2004; Conny and Tedesco, 1983; Wright, 1979) From here, efferent impulses give rise to the spasmodic and uncoordinated muscle movement characteristic of gagging. (Andrews and Widdicombe, 1993) Since the center in the medulla oblongata is close to the vomiting, salivating, and cardiac centers, these structures may be stimulated during gagging. (Davenport, 1982) Also, the neural pathways from the gagging center to the cerebral cortex allow the reflex to be modified by higher centers. (Davenport, 1982)

Gagging Severity

The patient who gags may present with a range of disruptive reactions, from simple contraction of palatal or circum oral musculature to spasm of the pharyngeal structures,

accompanied by vomiting. (Logemann, 1988) Gagging may be accompanied by excessive salivation, lacrimation, sweating, fainting, or in a minority of patients, a panic attack. (Conny and Tedesco, 1983)

Gagging Severity Index (GSI) by Dickinson (Dickinson, 2000; Dickinson and Fiske, 2005)

I Very mild:	Controlled by patient
II Mild:	Control regained by patient/ dentist with simple control techniques and reassurance
III Moderate:	Limits treatment options
IV Severe:	Some treatments impossible
V Very severe:	Effects patient's behavior and dental attendance. No Treatment possible.

Etiology

Gagging is believed to have a multifactorial etiology (Hoad-Reddick, 1986). It is complex and not fully understood. Gagging can become a conditioned response that makes dental treatment difficult or impossible for both the individual and the dentist. In extreme cases it can result in the avoidance of dental care. (Malkoc *et al.*, 2013; Bassi *et al.*, 2004; Fiske and Dickinson, 2001) Landa in 1954 suggested that majority of patients show history of a precipitating cause (Landa, 1954). The various etiological factors leading to gagging can be (Bassi *et al.*, 2004),

1. Tactile or Somatogenic
2. Non Tactile or Psychogenic (Bassi *et al.*, 20014; Murphy, 1979; Wilks, 1983)
 - a. Visual
 - b. Auditory
 - c. Olfactory
 - d. Imaginary/ Provoked by thoughts (Kovats, 1971)
3. Psychological
4. Preexisting Conditions
 - a. Anatomic
 - b. Local
 - c. Systemic
5. Factors pertaining to Operator
6. Others

1. Tactile or Somatogenic

Gagging is a normal defense mechanism that prevents foreign bodies from entering the trachea, pharynx or larynx. It is a natural reaction to tactile stimulation of certain intraoral structures. There is a wide variation in the sensitivity of the oral cavity and the ability of the patients to withstand intraoral stimuli. (Bassi *et al.*, 2004; Landa, 1954; Leslie, 1940) Five intraoral areas which can be the trigger zones are Palatoglossal and Palatopharyngeal folds, base of the tongue, palate, uvula and posterior pharyngeal wall. (Bassi *et al.*, 2004; Meeker and Magalee, 1986)

2. Non Tactile or Psychogenic

Visual, auditory or olfactory stimulus may initiate gagging. For example, the sight of white coat, blood or dental chair and equipment may lead to gagging. Others may gag with the sound of the hand piece or even on hearing the other person gag. Even dental smells like that of eugenol, impression pastes and restorative materials and other smells like cigarette and

other obnoxious smells may illicit gag reflex in patients. On other instances, certain thoughts may also be potent enough to stimulate gagging in some patients. (Kovats, 1971) It can be a physical expression of panic, related to a feeling that some threat to breathing or swallowing is about to occur. However it may not be easy to distinguish between two etiological factors because physical stimuli may still provoke gagging of psychogenic origin. (Malkoc *et al.*, 2013; Bassi *et al.*, 2004)

3. Psychological

A lot of orofacial conditions have been identified which have a strong psychological basis, gag reflex being one such kind. The others are temporomandibular pain dysfunction syndrome, atypical facial pain, burning mouth syndrome etc. (Bassi *et al.*, 2004; Newton, 1984) It is also observed that the personality of patients with a marked gag reflex is no different from non gaggers when neuroticism, extroversion and psychoticism were evaluated. (Bassi *et al.*, 2004; Murphy, 1979; Wright, 1980) Wright in 1980 used Eysenck Personality Questionnaire to examine the personalities of dental patients who retched while attempting to wear denture. There was no evidence to suggest that retching patients were more neurotic than the control group. (Wright, 1980) Hence, the behavior or response of a person in stressful situations is mainly governed by various learning theories which have been put forth. Classical conditioning and Operant conditioning being the major ones. (Bassi *et al.*, 2004; Humphris and Ling, 2000) Classical conditioning occurs when an originally neutral stimulus is paired with a specific behavioral response. (Bassi *et al.*, 2004; Ramsay *et al.*, 1987) Gagging may initially occur as a response to overloaded impression tray, but the patient then starts to associate neutral stimuli like dental operatory, dentist, impression tray, smell of the impression material with gagging and hence a conditioned gag reflex develops to these stimuli. (Bassi *et al.*, 2004; Kovats, 1971; Newton, 1984) Operant conditioning is a training process whereby the consequence of a response changes the likelihood that the individual will produce that response again. Some behavior patterns may be reinforced because they secure attention and sympathy (positive reinforcement), avoid a stressful situation (negative reinforcement), or achieve some other desirable result. (Bassi *et al.*, 2004; Newton, 1984; Ramsay *et al.*, 1987) For example, a patient gagging because of an overloaded impression tray may learn to associate it with temporary suspension of treatment. So this patient will gag every time he wishes to avoid stressful situations like a dental visit. It has been reported that psychological factors were identified in all patients with strong anxiety indicated as the probable cause of the gag reflex. (Malkoc *et al.*, 2013; Saita *et al.*, 2013)

4. Preexisting Conditions

a. Anatomic

A relatively long soft palate or a sudden drop at the junction of hard and soft palates may often lead to an excessive gag reflex. An atonic and relaxed soft palate may also elicit gagging by allowing the uvula to contact the tongue and the soft palate to touch the posterior pharyngeal wall. (Wright, 1981) Schote in 1959 related the gag reflex to the vomiting reflex and described that vomiting center lies in the dorsal portion of the lateral reticular formation of medulla oblongata, and to some extent, included tractus solitarius. (Schote, 1959)

b. Local

Certain other causes which can predispose a person to gag include not being able to breathe through your nose properly, catarrh, sinusitis, nasal polyps and mucus in the upper respiratory tract, a dry mouth, and medications that cause nausea as a side effect. (Bassi *et al.*, 2004; Landa, 1954; Wright, 1981; Bartlett, 1971) It has also been suggested that the distribution of the afferent neural pathway, particularly the vagus nerve, may be more extensive in gagging patients compared with non gagging patients. (Wright, 1979; Saita *et al.*, 2013) Enlarged areas of sensory innervations cannot, however, explain why patients gag with auditory, olfactory, or visual stimuli. (Newton, 1984)

c. Systemic

Certain medical conditions are more prevalent in gaggers. (Conny and Tedesco, 1983; Wright, 1981) Chronic gastrointestinal disease, chronic gastritis, diaphragmatic hernia, partial gastectomy, peptic ulceration and carcinoma of the stomach can lower the intraoral threshold for excitation and contribute to gagging. (Bassi *et al.*, 2004; Faigenblum, 1968) Wright in 1980 found a higher incidence of gastric conditions in gaggers. It has also been observed that gagging is worse in the morning. This is because of the increased excitability of the vomiting center caused by metabolic disturbances such as carbohydrate starvation and dehydration with ketosis. (Bassi *et al.*, 2004; Wright, 1981) Parasympathetic impulses from severe pain sites other than gastrointestinal tract may also cause gagging.

5. Factors pertaining to the Operator / Technique

Poor technique followed by the operator may also illicit a gag reflex in patients who are sensitive. For example, an overloaded tray while impression making, wrong consistency of the impression paste leading to dripping of the paste in the posterior region of the tongue and the pharyngeal area, overextended trays impinging on the 'trigger zones', patient reclining while making a maxillary impression etc. Landa suggested that correct occlusion and balanced articulation are critical for minimizing the gag reflex. A stable occlusion causes the denture to compress the underlying tissues. Conversely, instable occlusion produces movement of the denture base, which in this produce a tickling sensation and gagging. (Landa, 1954) It is also observed that patients tend to gag more with a dentist who doesn't seem confident about his work and also if he/ she is way too commanding and does not show empathy towards the patient.

6. Others

Some people gag because they have been abused in the past. A fear of gagging and throwing up is also a common feature in emetophobia (the fear of vomiting). Heavy smoking and heavy consumption of alcohol have also been associated with gagging. (Dua *et al.*, 1998)

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