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# **Gag Reflex, Treatment Options and Procedures**

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degree

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بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ

نَرْفَعُ دَرَجَاتٍ مِّنْ نَّشَأٍ

وَفَوْقَ كُلِّ ذِي عِلْمٍ

عَلِيمٍ

صَّبَّحْتَ بِرَبِّكَ الْعَظِيمِ

من سورة يوسف/ جزء من الآية (٧٦)

## **Declaration**

I certify that this project entitled " **Gag reflex, Treatment Options and Procedures** " was prepared by the fifth-year student Maram Dheyaa Fadhil under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the bachelor's degree in Dentistry.

**Assist. Lec. Dr. Zinah Salah Mawlood**

## **Dedication**

All thanks to Allah for giving me the strength to do the best I can and to  
be in place.

They said, "The women who were prevented from running will give birth  
to women with wings."

To whom gave me wings from the depths of grief

To whom suffered, endured, and waited till the end

To my mother

To whom God made a supporting spirit for me, encouraged and always  
told me, "You can."

To Abeer

To everyone who wished me the best.

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## List of Abbreviations

CN IX	Cranial nerve 9
CN X	Cranial nerve 10
CN V	Cranial nerve 5
CN 12	Cranial nerve 12
GSI	Gagging Severity Index
PPS	Posterior Palatal Seal
CBT	Cognitive Behavioral Therapy
VD	The Vertical Dimension
GNB	Glossopharyngeal Nerve Block
CNS	Central Nervous System
5-HT3	5-hydroxytryptamine
IV	Intravenous
nm	nanometer
cm	centimeter
HZ	Hertz
mW	milliwatts
mm	millimeters
ml	milliliter
3D	Three dimensional
CV-24	Conception vessel-24

## **Introduction**

The gag reflex also called gagging is a normal, defensive, physiological mechanism that happens to forestall foreign bodies or toxic materials from getting entry to pharynx, larynx or trachea (**Kaira *et al.*, 2014**).

In 1959, Schote found a relation between gag reflex and vomiting reflex and revealed that gagging center and vomiting center lies in dorsal portion of lateral reticular formation of medulla oblongata and may include tractus solitarius (**Schole, 1959**).

In 1970, Means and Flennien stated that mechanisms of swallowing and gagging are also physiologically related to each other as both mechanisms share similar afferent neural pathways, brain centers and efferent neural pathways (**Means and Flennien, 1970**).

A prosthodontist commonly encounters patients with gagging while providing prosthodontic treatment (**Van Houtem *et al.*, 2015**).

Various stimulating or triggering factors of gag reflex in prosthodontic patients but broadly the gag reflex has been classified as either somatogenic or psychogenic (**Dickenson and Fiske, 2005; Ahmad *et al.*, 2015**).

Somatogenic gagging starts from insufficient retention of the prosthesis, thick posterior borders of the denture, inadequate posterior seal, lack of tongue space and malocclusion. Psychogenic gagging is triggered by anxiety, taste, fear and apprehension (**ALI *et al.*, 2018**).

Some factors contribute and initiate gagging in patients, these are categorized as anatomical, medical, psychological and dental/iatrogenic factors (**Bassi, 2004; Goyal, 2014**).

There are different levels of severity of this problem in different patients. Faigenblum categorized such patients by severity of the problem. The prosthodontic patient's gagging problems were divided into mild and severe in this study (**Eachempati *et al.*, 2019**).

Identifying the severity of this condition enables the physician to determine if the patient can handle standard treatment techniques or an alternative method must be considered (**Dickinson and Fiske, 2006**).

Numerous authors have discussed various etiologies, methods of assessment and symptoms of gagging. Many treatment modalities including psychological intervention, prosthodontic management, systemic desensitization, pharmacological methods, surgical correction, acupressure and acupuncture have been tried to curb the gag Reflex (**patil et al., 2020; patil et al., 2021**).

## **Aims of the study**

To review the mechanism, etiology, clinical features of gag reflex, and the role of different methods to treat gagging in the prosthodontic clinic.

## *Chapter One: Literature Review*

## 1.1 The Nature of the gag reflex

The gag reflex is a normal protective and healthy defense mechanism of the human body. This reflex prevents entry of foreign objects into trachea and lower airway. Initially, there is puckering of the lips aiming to close jaws. The tongue is then elevated with rotation postero-anteriorly and with the hyoid bone at the center. Then, soft palate and hyoid bone gets elevated followed by fixation of the hyoid bone. It is followed by contraction of anterior and posterior faucial pillars, rotation of tonsils in an anteromedial direction and elevation, contraction and retraction of the larynx with closure of the glottis. Simultaneous, uncoordinated spasm of respiratory muscles may occur followed by vomiting. On stimulation of trigger zones, afferent impulses are transmitted to gag reflex center in the medulla oblongata. From this gag reflex center, efferent impulses are transmitted to effector cells located in the same initial region that can carry out the appropriate response. This results in uncoordinated spasmodic movements of pharyngeal muscles causing gagging. The gagging center lies near the vomiting, salivating and cardiac centers in medulla oblongata. This explains why gagging is frequently associated with these additional reflexes like increased salivation, increased lacrimation, increased heartbeat, etc (Sarwono, 2022).

## 1.2 The Development of the gag reflex

The gag reflex is mediated by the glossopharyngeal nerve (CN IX) and the vagus nerve (CN X). Embryologically, the glossopharyngeal nerve is associated with the derivatives of the third pharyngeal arch, while the vagus nerve is associated with the derivatives of the fourth and sixth pharyngeal arches (Frisdal and Trainor, 2014).

In the first few months of life, the gag reflex is triggered by any food that the nucleus tractus solitarius deems too large or solid for a baby to



digest. Starting around six or seven months of age, the gag reflex diminishes, allowing infants to swallow more solid foods (**Stevenson and Allaire, 1991**).

### **1.3 The Mechanism of the gag reflex**

The gag reflex can be classified as either somatogenic or psychogenic. A somatogenic gag reflex follows direct physical contact with a trigger area, which may include the base of the tongue, posterior pharyngeal wall, or tonsillar area. A psychogenic gag reflex presents a mental trigger, typically without direct physical contact. In cases of psychogenic gag reflexes, even the thought of touching a sensitive trigger area, such as occurs when going to the dentist, can induce gagging (**Saunders and Cameron, 1997**).

The gag reflex is controlled by both the glossopharyngeal (CN IX) and vagus (CN X) nerves, which serve as the afferent (sensory) and the efferent (motor) limbs for the reflex arc, respectively. The nerve roots of cranial nerves IX and X exit the medulla through the jugular foramen and descend on either side of the pharynx to innervate the posterior pharynx, posterior one-third of the tongue, soft palate, and the stylopharyngeus muscle (**Klimaj *et al.*, 2020**).

The stimulus is provided by sensation to the posterior pharyngeal wall, the tonsillar pillars, or the base of the tongue. These sensations are carried by CN IX, which acts as the afferent limb of the reflex to the ipsilateral nucleus solitarius (also referred to as the gustatory nucleus) after synapsing at the superior ganglion located in the jugular foramen. In turn, these nuclei send fibers to the nucleus ambiguus, a motor nucleus in the rostral medulla. Efferent nerve fibers to the pharyngeal musculature traverse from the nucleus ambiguus through CN X, as shown in (figure:1), resulting in the bilateral contraction of the posterior pharyngeal muscles. Contraction of the pharyngeal musculature ipsilateral to the side of the stimulus is known

as the direct gag reflex, and contraction of the musculature on the contralateral side is known as the consensual gag reflex. Stimulation of the soft palate can also elicit the gag reflex; in this case, the sensory limb is the trigeminal nerve (CN V). Here, sensory stimulation of the soft palate travels through the nucleus of the spinal tract of the trigeminal nerve (Sivakumar and Prabhu, 2022).

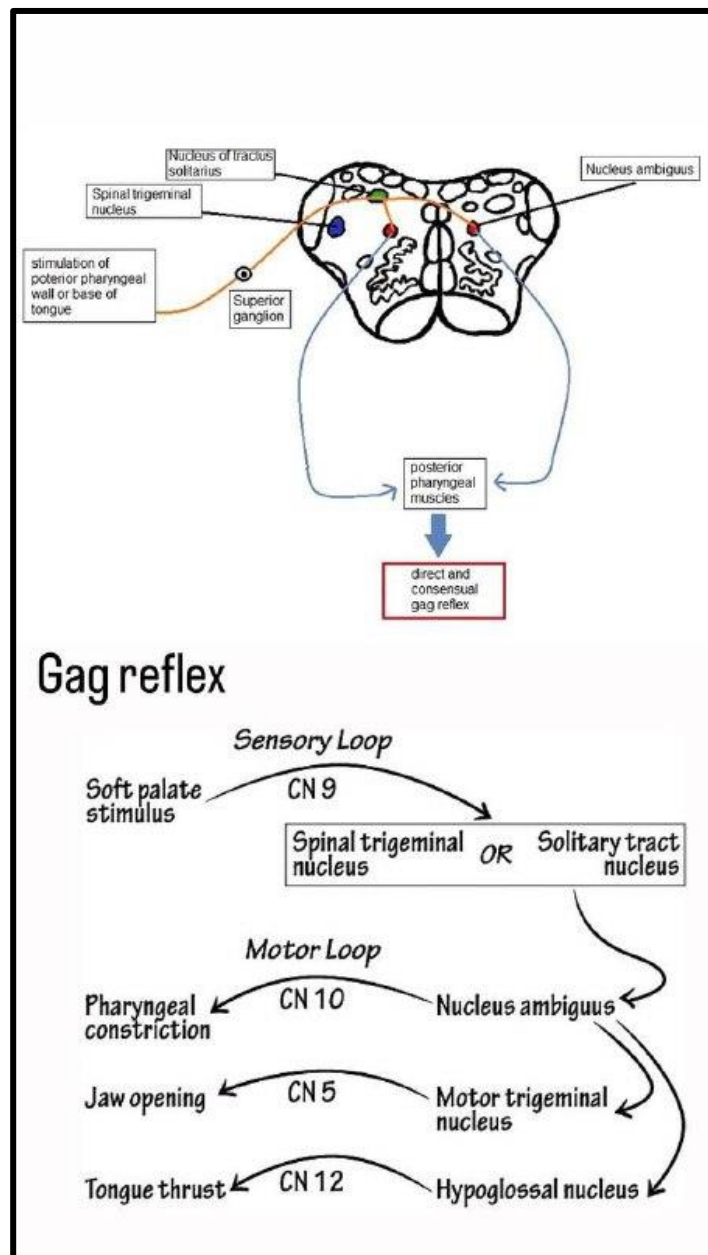


Figure 1: the mechanism of gag reflex. (Fisch, 2012;Sivakumar and Prabhu, 2022)

## **1.4 Method for examining the susceptibility of gagging**

### **1.4.1 Equipment used in the examination of gagging**

The gag reflex can be elicited using a tongue blade or soft cotton applicator. However, a suction device may be most convenient for testing in an intubated patient (**Sivakumar and Prabhu, 2022**).

### **1.4.2 Technique used in the examination of gagging**

The examiner stimulates the posterior pharynx using a tongue blade or cotton applicator. After doing so, the patient will produce a gagging reaction, which may lead to vomiting in some individuals. Additionally, the elevation of the bilateral posterior pharyngeal muscles requires examination. In a study among 104 medical students assessing the gag reflex, researchers noticed that stimulation of the posterior pharynx was more likely to elicit a gag reflex when compared to stimulation of the posterior tongue (**Abe *et al.*, 2014**).

An asymmetric response or absence of response when stimulating one side indicates the presence of pathology and warrants further assessment (**Sivakumar and Prabhu, 2022**).

### **1.4.3 Alternatives in the examination of gagging**

Soft palatal reflex can help to assess the function of CN IX and CN X, as this reflex may be intact in the absence of the gag reflex. The voice is evaluated by looking for hoarseness and dysphonia to determine CN X pathology. Research has also found that the cough reflex was better reproduced in intubated patients than the gag reflex to test for brainstem function (**Polverino *et al.*, 2012**).

#### 1.4.4 Contraindications in the examination of gagging

The gag reflex should not be performed during airway assessment for intubation in an obtunded patient due to the risk of vomiting and subsequent aspiration (**Mackway-Jones and Moulton, 1999**).

Assessing the oral cavity in patients with a hypersensitive gag reflex may be difficult. These patients may benefit from intravenous sedation during prosthodontic treatment (**Yoshida *et al.*, 2007**).

#### 1.5 Classification of gag reflex

Faigenblum classified gag reflex as mild form to severe retching. Patients showing mild retching may feel nauseated because of the reaction to the stimulus and they can control and manage the reaction on their own. There is no need for any clinician intervention. Most of the patients lie in this category. Severe forms of retching can also occur easily and may require physical intervention. Patients may get choking sensation (**Faigenblum, 1968**).

Morstad also classified gagging based on time duration, whether gagging occurred immediately after delivering of prosthesis or after certain delayed period (**Hajira *et al.*, 2020**) :

1. Immediate gagging – Overextension at post palatal region in maxillary denture or bulky distolingual flange in mandibular denture can cause this type of gagging. It occurs immediately on insertion of the prosthesis in patient's mouth.
2. Delayed – This type of gagging occurs in a period of two weeks to two months after denture insertion. Incomplete and improper border seal allows flow of saliva under the denture and stimulates the gag reflex.

Fiske and Dickinson gave Gagging Severity Index (GSI) and classified gagging into five grades (**Fiske and Dickinson, 2001**) :

1. Grade I (Normal/Obtunded gag reflex): This type of gagging is a very mild form and can be controlled and managed by the patient. It is present during dental treatment procedures like making maxillary impressions or restorative procedure of palatal, distal or lingual surfaces of molars.
2. Grade II (Mild/Partially controlled gag reflex): This is also a mild type of gagging. It can occur during dental treatment procedures such as scaling, restorations and impression making but does not limit dental procedure. Patients need assurance from the dentist to control gag reflexes.
3. Grade III (Moderate/Partially controlled gag reflex but frequent): This is a moderate type of gagging which sometimes restricts treatment procedure. It may occur during simple dental procedures such as clinical examination of regions such as lingual aspect of lower molars.
4. Grade IV (Severe/Inadequately controlled gag reflex): This represents a severe form of gagging and dental treatment becomes difficult without clinician interventions. This type of gag can occur with even simple visual examination.
5. Grade V (Very severe gagging): This form of gagging is very severe and can affect patient's behavior on dental chair. It occurs very easily, frequently and does not require any physical intervention to trigger the gag reflex. Dental treatment is highly impossible without proper management of gag reflex.

## 1.6 Etiology of Gagging

### 1.6.1 Local factors

These factors Include: Nasal obstruction, Deviated septum, Postnasal drip, sinusitis, Nasal polyps and congestion of the oral, nasal and pharyngeal mucosa (**Bassi *et al.*, 2004**).

### 1.6.2 Systemic Factors

These factors Include: alcoholism, smoking, chronic gastritis, carcinoma of the stomach, partial gastrectomy, peptic ulceration, cholecystitis, carcinoma of the pancreas, diaphragmatic hernia, uncontrolled diabetes and medication produces nausea as a side effect (**Dickinson *et al.*, 2006; Rubina, 2018**).

### 1.6.3 Psychological factors

These factors Include: Eating disorders, fear, stress, Neuroticism and learned responses (**Meenakshi *et al.*, 2021**).

### 1.6.4 Prosthetic factors

Prosthetic factors such as overextended denture borders (posterior portion of maxillary denture and distolingual region of mandibular denture may trigger regions resulting in a gag), inharmonious occlusions, poor retention of dentures, inadequate PPS, inadequate or excessive surface finish of the acrylic dentures and an inadequate freeway space also cause gagging reflex (**Dickinson and Fiske, 2006**).

Patients reported that the issue was particularly severe in the morning hours during dental hygiene procedures and denture insertion process. The reason for this could be that the patients were not habituated to the stimulation that is caused by the dentures, as they were not worn at night for many hours (**Meenakshi *et al.*, 2021**).

### 1.6.5 Iatrogenic factors

These factors Include: suction and water tubes, instrumentation, radiography, poor clinical technique, and overloaded impression tray also

contribute to gagging. Finally, the psychosomatic factors classified under classical conditioning process and operant conditioning process also add to the factors responsible for gagging. The gag reflex may start due to an overflowing impression tray or if a significant quantity of water is collected in the mouth from the handpiece. Whenever the patient learns to strongly identify the stimuli as a trigger for gagging, a conditioned gag reflex to such stimuli may develop (**Patil *et al.*, 2020**).

Similarly, the operant conditioning process is a training strategy in which the outcomes of a response influence the chance that the subject will repeat that response. Some behavior patterns may be rewarded in operant conditioning because they gain attention and compassion, avoid a stressful circumstance, or accomplish another desirable result. One example is that a patient who gags unintentionally learns to identify it with the temporary cessation of therapy. This outcome is favorable for him since the patient gains from the action, that is the treatment comes to a halt, this is consistent with the operant conditioning process (**Bartlett, 1971; Ansuia *et al.*, 2012**).

### **1.7 Extraoral stimulation of gag reflex**

Extraoral stimulation of gag reflex such as visual and auditory stimuli. For example, the mere sight of impression trays, mouth mirror, and the smell or taste of various dental materials (**Kaira *et al.*, 2014**).

### **1.8 Intraoral Stimulation of gag reflex**

The palate is divided into two regions that show different responses namely, the hyposensitive and hypersensitive ones.

The hyposensitive anterior section is separated from the hypersensitive posterior section by a line imagined through the fovea palatine. In addition, the tongue is also divided into two different response regions: a hyposensitive anterior third and a hyper-sensitive posterior third. In that, the

posterior one-third of the tongue is the most sensitive region of the oral cavity (Goyal, 2014; Kaira *et al.*, 2014).

Apart from these, the prosthetic factors such as inadequate post dam indentures (causes gagging due to insufficient pressure exerted onto the palatal tissue and a shallow post dam causing tight pressure might give a tickling sensation that induces a gag reflex) (Kaira *et al.*, 2014).

### **1.9 Clinical features of gag reflex**

Feintuch described clinical features of a gagging patient. “As the body trembles and footrest is stamped, large tears roll down from the eyes. The face of the victim takes on the hue of apoplectic purple and the patient gasps for breath, at the same time attempting to eject the introduce from his mouth and his insides with them”. When uncontrolled spasmodic contraction of muscles of respiration occurs during retching, air is forcefully passed through the closed glottis, which produces a characteristic retching sound. Additionally, thoracic muscles undergo contraction which causes decreased venous return, dilating veins of facial region, leading to congestion and flushing of the face. Some extra-oral reflexes and symptoms can be seen during gagging. These include excessive drooling of saliva, lacrimation, sweating and coughing. Sometimes, the whole body shows a reaction in response to gagging. If the stimulus is still present, continuing, or repeated, extremely apprehensive or excited patient may collapse requiring urgent medical assistance (Kaira *et al.*, 2014).

### **1.10 Methods for the Management of Gag Reflex**

The treatment of a patient who shows mild to moderate gagging can be treated in routine dental practice. A patient who shows severe gagging, on the other hand, needs a change in both the dentist's behavior and the treatment approach (Rubina, 2018).



Prior briefing about the intraoral examination should be followed by the patient's consent and then the dental procedure. It is the job of the dental team to be empathic towards the patient's concerns, to begin a discussion with him, and to instill trust in the patient, Management of this reflex action should be subjective to individual patients (**Goyal, 2014**).

### **1.10.1 Psychological Intervention**

#### **1.10.1.1 Relaxation**

Relaxation techniques can assist to alleviate the memory of treatments performed. If the gag reflex is caused by anxiety, relaxation techniques may be beneficial. Relaxation can assist in alleviating or eliminating unhelpful thought processes. The patient is instructed to tense and release some muscle groups, beginning with the legs and moving up, while offering constant encouragement in a calm environment (**Goyal, 2014; Rubina, 2018**).

#### **1.10.1.2 Distraction**

The distraction technique could be useful for momentarily diverting the patient's focus and may enable short dental operations to be conducted while the patient's mind is detached from potentially uncomfortable conditions (**Gupa et al., 2012**).

Landa proposed that the dentist start a conversation with the patient about a topic of special interest to engage the patient (**landa et al., 1946; Kovats, 1971**).

Krol suggested a strategy to distract attention in which the patient is advised to lift and hold his leg in the air. During this, the patient's muscle fatigues because to keep the leg up, more and more conscious effort is required, this distracts the patient and reduces gagging (**Krol et al, 1963**).

According to Faigenblum, vomiting was impossible during apnea. So, to control this gagging reflex the patient was urged to increase his

expiratory effort at the expense of his inspiration. This process will result in apnea and thus discourage gagging (**Faigenblum *et al.*, 1968**).

Kovats described a method where the patient breathes audibly through his nose while repeatedly tapping the right foot on the floor. When concentrating on these tasks the patient's focus is shifted away from the gagging sensation. In addition to these methods, authors proposed that common salt be used to temporarily eliminate the gag reflex. On tip of the tongue, table salt is placed for a span of five seconds. The gag is suppressed by stimulation of the branches of chorda tympani at the taste buds in the anterior 2/3 of the tongue (**Chidiac *et al.*, 2001; Jain, 2018**).

Yet another method of managing gagging reflex is by the earplug method wherein the earplug functions as the stimulator of the external auditory canal thus controlling the overactive gag reflex, as shown in (figure:2, A) (**Cakmak *et al.*, 2014**).

Further, as quoted by Boitel temporal tap method deals with the digital stimulation of the temporoparietal suture in conjunction with suggestions that prospectively regulate the gag reflex as shown in (figure:2, B) (**Boitel, 1984**).

Herein, the authors also recommend closing their eyes and washing their mouths with icy water and distracting the patient's mind by asking the patient to count the numerical numbers (**Claire and Ian, 2016**).



**Figure 2: Earplug and temporal tap method (Samaleti and Jawdekar, 2020)**

### 1.10.1.3 Systematic desensitization

Desensitization is done systematically. Classical conditioning-learned behavior may be unlearned by reversing the conditioning process (**Rubina, 2018**).

This approach involves gradually exposing the patient to feared stimuli in such a manner that when the frequency, intensity, and duration of the unpleasant stimuli increases, it leads to the patient being gradually habituated to the treatment to be performed. The Marble Method is a successful desensitization method for the treatment of hopeless gaggers. During the initial appointment visit, no oral assessment of any type was performed using this approach. The patient was instructed to insert five, round glass, multi-colored marbles, roughly 0.5 inch in diameter, in his mouth one by one till all five marbles had been put in his mouth. The patient was then reassured that ingesting a marble would not endanger him, as the anxiety of ingesting a foreign item might cause gagging. Marble Technique is a successful desensitization method for treating terrible gaggers. Alongside this technique, at each weekly session, the patient was assured that he would be able to wear and use dentures. The patient was instructed to always maintain the five marbles in his mouth, except while eating and sleeping, for a duration of one week. The patient was able to tolerate the five marbles on the second appointment and was reassured again that he would eventually be able to wear dentures, this added to his determination. Before making impressions, the hard palate and soft palate, along with the cheeks, tongue and lips were swabbed with topical anesthetics on the third and fourth visits. Three marbles were instructed to be kept in the patient's mouth thereafter (**singer, 1973; Pisulkar et al., 2018**).

Wilks and Marks in 1983 advocated teaching the patient the procedure to swallow with their teeth apart, allowing the tip of their tongue to be more

anteriorly placed on the palate causing the muscles to relax, thus minimizing gagging from occurring (**Thessaloniki, 2021**).

Another technique was to brush the hard palate softly with a toothbrush without causing gag reflexes. On the toothbrush handle, the patient marks the location of the maxillary incisors. The goal was to move the brush further posteriorly, and the patient was motivated as the marking on the toothbrush moved down the handle progressively (**Robb and Crothers, 1996**).

#### **1.10.1.4 Cognitive Behavioral Therapy (CBT)**

This strategy tries to modify patients' irrational behavior patterns regarding dental procedures that may enhance the sensitivity of the gag reflex. Patients are challenged by CBT to dispute firmly established views about gagging catastrophes based on personal experience (**Barsby, 1997; Bassi et al., 2004**).

A psychotherapist, for example, can use CBT to rationalize a patient who cannot handle the water in their mouth, fearing that the excess volume of water will choke them (**Rubina, 2018; Meenakshi et al., 2021**).

### **1.10.2 Prosthodontic Management**

#### **1.10.2.1 The selection of trays**

The selection of trays during the prosthodontic procedures plays a very important role as an oversized tray can lead to gagging (**Meenakshi et al., 2021**)

#### **1.10.2.2 Patient position**

The patient's head must be bent down and he should always be in a seated and resting position during a dental impression (**Forbes-Haley and Blewitt, 2016; Meenakshi et al., 2021**)

#### **1.10.2.3 Material selection**

The utilization of a fast-setting material is preferred. Impression material should not be used when its consistency is thin. The impression

tray should never be overloaded with impression material, only an adequate amount of material is to be used to treat the patient with a shorter exposure time, use a rigid mix of impression materials and fast setting materials (like impression compound) (**turner *et al.*, 2012**).

#### **1.10.2.4 Posterior palatal seal area**

It should be recorded appropriately and should never be underdamped or overdamped. Many numbers of post dams are provided on the final maxillary denture base to allow customization according to the patient's preference (**Hoad-Reddick, 1986; Singh *et al.*, 2013**).

#### **1.10.2.5 Modification of maxillary custom tray**

Modification of maxillary custom tray can be used to prevent gag reflexes. It is preferable to utilize these trays using disposable saliva ejectors at their distal end, allowing surplus impression material to pass through these regions without activating the soft palate (**Witter *et al.*, 1999**).

A major connector with a 'horseshoe' design minimizes palatal coverage, resulting in less interference for the tongue (**Meenakshi *et al.*, 2021**).

#### **1.10.2.6 Recording jaw relations**

The vertical Dimension (VD) at occlusion must be recorded correctly because as VD decreases, room for the tongue diminishes, causing the tongue to sink back and produce a gag reflex (**Witter *et al.*, 1998; jain *et al.*, 2013**).

#### **1.10.2.7 Final Prosthesis Fabrication**

A well-fitting denture must be provided to reduce the most common etiologies of gag reflex, i.e., Denture looseness, thick palatal coverage, thickened denture posterior border, narrow arch bringing cusps of posterior teeth near the tongue's dorsal surface (**Akeel *et al.*, 2000; Yadav *et al.*, 2011**).

### 1.10.2.8 Use of Training Bases

This is another desensitization strategy in which the patient is gradually given a series of small to full-sized denture bases. This procedure is beneficial to people that are about to start wearing dentures for the first time. A thin denture base made of acrylic, without teeth is made, and the patient is advised to use it at home for a period that gradually increased. A reasonable regimen maybe for 5 minutes once a day, then twice a day progressing forward (**Fløsystrand *et al.*, 1986; Akeel *et al.*, 2000**).

One week later, the patient is instructed to raise this time to 10 minutes three times each day, and then for 15, 30 and 60 minutes each day. Finally, the patient can endure these training bases for most time of the day. According to the patient's requirements and expectations, the time-frame and the rate of improvement will differ ( **Pushpa *et al.*, 2021; Pati *et al.*, 2022**).

If issues arise, the extension of the denture's posterior border may need to be reduced. Anterior teeth are introduced into the original training base, and posterior teeth are introduced when the patient can bear it. Compromises in denture fabrication standards are unproductive. The retention and denture stability should be improved. Palate-less denture use has been demonstrated to be beneficial for certain patients, and retention failure in such cases is not usually significant (**Bassi *et al.*, 2004; Yadav *et al.*, 2011**).

### 1.10.2.9 Making implant-retained prostheses

This process allows a decrease in prosthetic size and extension thus reducing the overall coverage and lowering gagging reflex (**Forbes-Haley *et al.*, 2016**).

### 1.10.2.10 Roofless dentures

Gagging is reduced or eliminated when palatal coverage is reduced. Maxillary dentures could be shortened and made into a U-shaped

boundary which is around ten millimeters from the dental arch  
(Thangarajan *et al.*, 2017).

#### 1.10.2.11 Matte finished dentures

A very smooth, highly polished denture surface that is coated with saliva might induce a slimy sensation in some patients, causing gagging; in this situation, a matte surface has been proposed as more acceptable (Meenakshi *et al.*, 2021).

#### 1.10.2.12 Post insertion denture issues

Immediately after denture insertion, gagging is likely to occur owing to the two factors namely, maxillary dentures (an overextension of maxillary denture as well as an extensively thick posterior border) and mandibular dentures (distolingual flange of the denture maybe extensively thick) (Fløyststrand *et al.*, 1986).

Some of the patients complain of delayed gagging which is 2 weeks to 2 months after insertion for reasons such as: An incomplete border seal in the denture or malocclusion that causes the denture to loosen both of which allows saliva to seep under the denture to induce gagging (Meeker and Magalee, 1986; Ali *et al.*, 2018).

### 1.10.3 Pharmacological Methods

When clinical and prosthodontic therapy fails to reduce gagging, pharmaceutical approaches are considered. The drugs used to treat gagging are classified under the following sections (Krol, 1963; Kramer and Braham, 1977; Jain, 2018) :

#### 1. Peripherally acting agents –Local and topical anesthetics

The rationale behind using such medications is that if the afferent signals from more sensitive oral tissues are blocked, the gag response is prevented. Some authors recommend infiltrating the palatine nerves with local analgesia for maxillary impression taking. While others recommended numbing the soft palate, employed local anesthetic sprays

and utilized swabs for topically application of a local anesthetic to the palate before impressions.

Similarly, added local anesthetic into the alginate impression material (**Bassi, 2004**).

It is well known that the glossopharyngeal nerve block (GNB) is a generally safe, uncomplicated, and easy-to-learn technique for treating patients with excessive gag reflexes. GNB can be utilized in dental treatments in individuals who have an overactive gag reflex or while doing operations at the back of the mouth (**Murthy *et al.*, 2011**).

The GNB procedure was carried out with the operator standing contra laterally to the side to be blocked and the patient's mouth wide open. The palatopharyngeal fold (posterior tonsillar pillar) was identified, and a tongue blade (held in the non-dominant hand) was used to move the tongue medially (towards the contralateral side), establishing a gutter between the tongue and the teeth. A syringe with a 25-gauge needle was inserted into the membrane near the base of the anterior tonsillar pillar and inserted about 0.25 to 0.5 cm, then after careful aspiration, 3 ml of 2% lignocaine solution with 1:200000 epinephrine was slowly injected, and the injection was performed on the opposite side (**Murthy *et al.*, 2011**).

## 2. Centrally acting agents

Several marketed drugs act on the nervous system and classified under centrally acting agents as represented in the table 1.

**Table 1: Centrally acting agents**

Class of drug	Name	Mode of action
Conscious sedation	Nitrous oxide	Alters the perception of external stimuli and thus this depresses the gag reflex <b>(Yagiela, 2001; Rubina <i>et al.</i>, 2018)</b> .
Serotonin antagonists	Ondansetron Granisetron	5-HT <sub>3</sub> receptors in the chemoreceptor trigger zone and gastrointestinal tract are blocked <b>(Athavale <i>et al.</i>, 2020)</b> .



Class of drug	Name	Mode of action
CNS depressants	Intranasal midazolam	Short-acting benzodiazepine central nervous system (CNS) depressant. Nasal anesthesia has several benefits, including a quick absorption period and a rapid release process of anesthetics transmitted to the systemic circulatory system ( <b>Malkoc <i>et al.</i>, 2013</b> ).
Antihistamines	Benadryl Diphenhydramine hydrochloride	Histamine binding to cellular receptors on nerve terminals, smooth muscles, and glandular cells is competitively antagonized, thus depressing the gag reflex ( <b>Goyal, 2014; Jain, 2018</b> ).
Dopamine antagonists	Metoclopramide Domperidone	Block dopamine type 2 (D2) receptors both centrally and peripherally in the chemoreceptor trigger zone in the gastrointestinal tract respectively ( <b>Jain, 2018</b> ).
Anticholinergics	Hyoscine Dicyclomine	Muscarinic receptors in the vestibular nucleus, vomiting center, and higher brain centers are blocked ( <b>Athavale <i>et al.</i>, 2020</b> ).
Sedative	IV Propofol	Antagonist at the 5HT3 receptor, as well as by regulation of subcortical pathways ( <b>Jain, 2018; Kampo <i>et al.</i>, 2019</b> ).
The last option that a dentist will resort to is general anesthesia ( <b>Forbes-Haley <i>et al.</i>, 2016</b> ).		

#### 1.10.4 Surgical Correction

Described a surgical procedure for relieving gagging in patients who could not tolerate complete dentures. The theory behind this approach is based on the fact that recurrent gagging is caused by a relaxed soft palate, which is common in anxious patients. This procedure was mainly recommended to shorten and tighten the soft palate to remedy this issue (**Kaira *et al.*, 2014; Jain, 2018**).

### 1.10.5 Acupuncture and Acupressure Therapy

Acupuncture therapy is a medical method in which a small needle is put into the skin to a few millimeters, kept in place for a while, occasionally adjusted, and finally withdrawn. Ear acupuncture is considered a non-invasive treatment method. This method produces very slight discomfort, it is inexpensive, and takes minimal extra clinical time (Kaira *et al.*, 2014).

Acupuncture is a highly safe practice if fundamental anatomy and aseptic precautions are followed by a properly qualified practitioner. Ear acupuncture was hundred percent effective for regulating the gag reflex, according to some authors as shown in (figure:3) (Kaira *et al.*, 2014; Anand *et al.*, 2015).

The mechanism of action of this treatment might be explained by the fact that one of the few primary nerves that is involved in the swallowing mechanism, the vagus nerve, also stimulates a portion of the ear which houses the acupuncture point for anti-gagging. This site is also close to the trigeminal nerve branch. Both the trigeminal and vagus nerves work together to control many of the motor and sensory activities of the larynx, throat, and palate. As a result, activating these anti-gagging points triggers systems that inhibit the gagging reflex (Dickinson and Fiske, 2005; Hashim *et al.*, 2017).



**Figure 3: Ear anti-gagging point (Meenakshi *et al.*, 2021).**

After disinfecting the skin with 70% alcohol at the location of the needle penetration, one tiny, single-use disposable needle (0.35 mm 40 mm) was pierced to a depth of 3 mm directly above the tragus in each ear's anti-gagging point. Before performing the dental treatment, the needles were spun clockwise and then anticlockwise for a span of thirty seconds. The needles were kept in place during the impression-taking procedure and were withdrawn once the impression tray was withdrawn from the patient's mouth (**Hashim et al., 2017**).

Acupressure works on the same principles as acupuncture, but the former uses mild finger pressure to stimulate the points rather than small needles, making it a less intrusive procedure. The acupressure procedure should begin about 5 minutes before the impression procedure. It is continued during the impression operations and is terminated only after the impression has been completely removed from the patient's mouth. The patient, dental assistant, or dentist can all apply pressure (**Gupta et al., 2012; Kaira et al., 2014**).

**Table 2: Provides details of the various pressure points that have been employed for relieving gagging reflex.**

Pressure point	Location	Procedure
CV-24 point (Fig. 4a)	Horizontal mentolabial groove, roughly halfway between the lower lip and the chin	With the index finger, Use gentle finger pressure. Gradually increase finger pressure until the patient feels discomfort/pain and distension ( <b>Vachiramon and Wang, 2002; Sari and sari, 2010</b> ).
He Gu (Fig. 4b)	Between the thumb and the forefinger	When the thumb and index fingers are pulled together this point is positioned on the highest point of the muscle ( <b>Jain, 2018</b> ).

Pressure point	Location	Procedure
Nei Guan point (Fig. 4c)	Inner forearm between the two tendons	Three finger breadths underneath the wrist on the forearm are pressed. It is widely used to treat nausea, motion sickness, carpal tunnel syndrome, stomach upsets and headaches ( <b>Vachiramom and Wang, 2002; Sari and sari, 2010</b> ).
Yintang (Fig. 4d)	Midway between the medial ends of the eyebrows	With the index finger, Use gentle finger pressure. Virtually used to treat insomnia and anxiety ( <b>Rowbotham, 2005; Thangarajan et al., 2017</b> ).

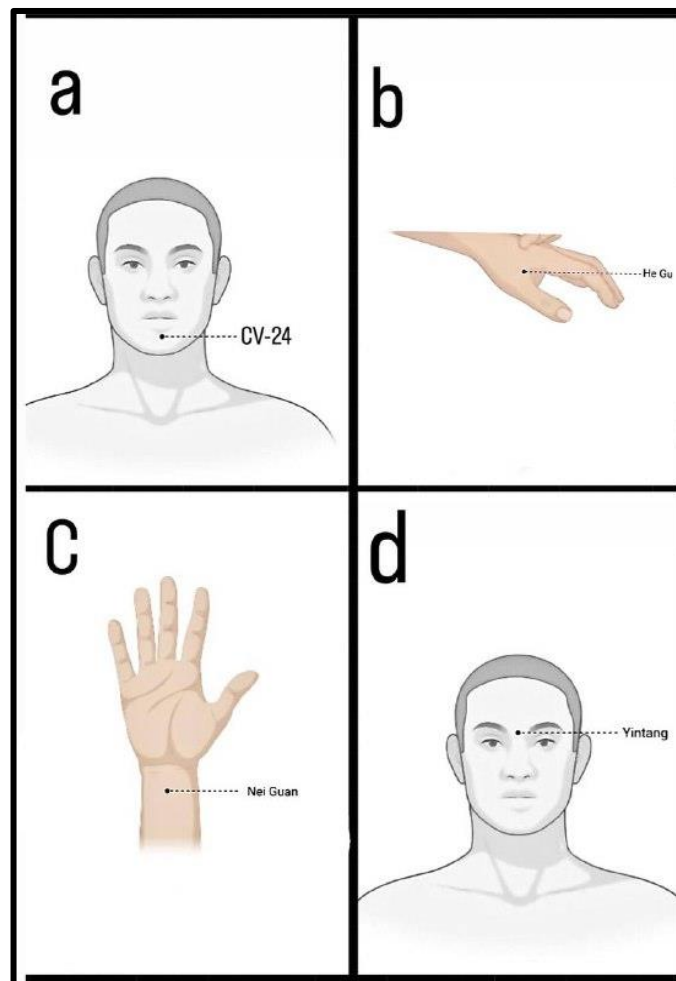
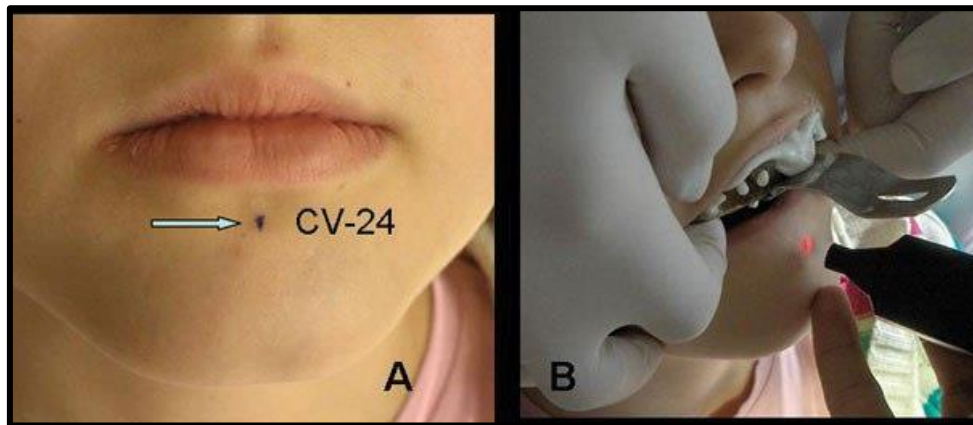


Figure 4: The Pressure points (Meenakshi et al., 2021).

### 1.10.6 Laser Stimulation

For 1 minute, a red-light soft laser with a power output of 0.5 mW and a wavelength of 650 nm, a pulsating magnetic field of 9 Hz, and a penetration depth of 30 cm was utilized to stimulate (CV 24) point as shown in (figure:5).The red-light soft laser triggers the organism's bioenergetic regulatory mechanisms at the cellular level. At 1 cm from the laser probe, the laser was applied directly to the skin. Laser treatment on acupuncture point CV 24 has been shown to be an effective treatment option for orthodontic patients with gagging reflexes (**Sari and sari, 2010**).



**Figure 5: A. The acupuncture point conception vessel 24 (CV 24)  
B. View of a red-light soft magnetic field laser stimulation on CV 24  
(Sari and Sari, 2010).**

### 1.10.7 Intraoral scanning systems

The use of intraoral scanners for study models has increased dramatically among dentists. Digital scanners can obtain high quality impressions and reduce the gag reflex and several problems (**Grünheid *et al.*, 2014**).

Digital impressions can offer a variety of advantages such as reduced patient discomfort, time-efficiency, simplified clinical procedures, and ability of capturing and storing highly accurate information (the 3D virtual models of patients) without pouring stone casts. The possibility of avoiding

pouring stone casts can save space and time in the clinic. Further advantages of the digital impressions and scanning systems are the possibility to easily transfer digital data to the dental technician, *via* email, avoiding impression shipping to the laboratory: this results in a better communication with the laboratory (**Grauer *et al.*, 2011**).

## ***Chapter Two: Conclusion***

**2. Conclusion**

The gag reflex is a common problem that can interfere with daily activities and proper function. There is no single approach that works for effectively controlling it, but a variety of modalities can be used depending on the patient's conditions. A comfortable and effective treatment can be achieved with the right patient education and motivation, as well as a cautious approach and attentive work by the dentist. This review provides an overview of the numerous treatment techniques that have been scientifically supported in the literature.



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