

TO DETERMINE THE ASSOCIATION OF GAG REFLEX WITH TYPES OF SOFT PALATE A CASE-CONTROL STUDY

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ABSTRACT

OBJECTIVES

This study aimed to assess the association between the gag reflex and soft palate types.

METHODOLOGY

This case-control study was conducted in Khyber College of Dentistry, Peshawar. The study included 120 participants divided equally into gag reflex (case=60) and non-gag reflex (control=60) groups. Gag reflex was categorized according to Dickinson and Fiske's Gagging Severity Index. Grade 1 was considered normal and allotted to the control group. Grade 2 was considered mild gagging; Grade 3, moderate; and Grades 4 & 5, severe. The soft palate was categorized according to the House classification into Class I, Class II, and Class III. Sodium Alginate impressions were recorded for patients; those who experienced gagging during impression-taking were included in the case group, while those who did not were included in the control group.

RESULTS

Of 120 patients, 39.2% were male, and 60.8% were female. Compared to the control group, gag was significantly associated with Soft Palate type II (Odds Ratio: 4.97; 95% CI: 2.24 to 11) and Soft Palate type III (Odds Ratio: 5.88; 95% CI: 1.0 to 33.36). Also, a significant association of the gag reflex was observed with motion sickness ($p=0.001$), Gastro-esophageal Reflux Disease ($p<0.001$), and Mouth breathing ($p=0.005$). Age, gender, and education were not associated with the gag reflex.

CONCLUSION

There is a significant association between the gag reflex and soft palate type, motion sickness, and GERD.

KEYWORDS: Gag Reflex, Soft Palate, Impression Recording, Prosthodontic Treatment.

INTRODUCTION

One of the most common issues encountered during impression recording is an exaggerated gag reflex. The gag reflex is an involuntary contraction of the soft palate or pharynx that triggers retching.² A normal gag reflex serves as a protective mechanism, regulated by the primary parasympathetic division of the autonomic nervous system, to prevent foreign objects and harmful substances from entering the pharynx, larynx, or trachea.³ Abnormal or exaggerated gag reflex can be a troublesome issue that affects all facets of dentistry, from diagnostic procedures to active treatment, and can cause distress for everyone involved, particularly during prosthodontic procedures.⁴ Clinical manifestations of the gag reflex include additional signs and symptoms such as sweating, weakness, altered breathing, increased heart rate, and increased salivation.⁵ The gag reflex is classified into somatogenic and psychogenic types. Somatic gagging is triggered by sensory nerve stimulation from direct

contact, while the higher brain centre influences psychogenic gagging.⁶ In somatic gagging, touching a specific trigger area prompts the reflex. Although trigger areas vary among individuals, common sites include the lateral border of the tongue and certain regions of the palate. Somatogenic gagging can also arise from inadequate retention of the prosthesis, thick posterior borders of the denture, insufficient posterior seal, tongue space encroachment, and malocclusion.⁷ Psychogenic gagging can occur without any direct contact. The mere sight, sound, smell, or thought of dental treatment can provoke the reflex.⁸ A clear division between the somatic and psychogenic reflexes is not feasible. Somatogenic and psychogenic gagging may occur separately or a combination of both types may be present.⁹ Several factors can trigger and initiate gagging in patients, which are classified as anatomical, medical, psychological and dental/iatrogenic factors.¹⁰ Local anatomical factors include nasal obstruction, post nasal drips, nasal polyps, congestion of the oral, nasal and pharyngeal mucosa, chronic

diseases of gastrointestinal tract, dentures, and increased OVD.¹¹ Various studies have employed different indices to quantify the severity of gag reflex, such as the gag severity index (GSI), the gag prevention index (GPI), the gag problem assessment (GPA), the visual analogous scale and measuring the depth of swap penetration into the soft palate.¹² GSI was introduced by Fiske and Dickinson, which classifies the gag reflex into five grades primarily based on level of difficulty experienced during dental procedures, such as recording impressions and performing restorations.¹³ Numerous techniques have been documented in the literature to mitigate the gag reflex during impression recording.¹⁴ Some research has demonstrated the efficiency of acupuncture and behavior modification.¹⁵ Pharmacologic agents that act either peripherally or centrally, e.g., topical and local anesthetics, as well as general anesthesia, also help control the gag reflex by blocking afferent impulses from sensitive oral tissues.¹⁶ There are two classifications of the soft palate: the Angle classification and the You et al. classification.¹⁷ Angle classification, proposed by MM House, describes the extent of soft palate that the posterior palatal seal will cover. According to House, there are three types of soft palates. *Class I*: More than 5 mm of movable tissues available for post-damming. *Class II*: 1-5mm of movable tissues available for post-damming, where good retention is typically achievable. *Class III*: Less than 1 mm of movable tissue available for post-damming, where retention is generally poor, often observed in conjunction with a high V-shaped palatal vault.¹⁸ You et al classified the soft palate into six morphological types based on digital lateral cephalogram (Type 1: leaf-shaped; Type 2: rat tail; Type 3: butt-like; Type 4: straight line; Type 5: S-shaped, and Type 6: crook-shaped).¹⁹ According to a study by Halboub E. et al., the prevalence of class I, class II, and class III soft palates was 53%, 33%, and 14%, respectively, and they found an association between soft palate type and the gag reflex.²⁰ According to one study by Kainat Alamgir, the prevalence of the gag reflex was found to be 55.14%.¹³ Nagham H Kassab reported a prevalence of 17.70% of gag reflex.²¹ According to another study by Meshni AA, 49.1% patients had a gag reflex. This study further evaluated gag reflexes according to patients' general health status and found that healthy patients (35.7%) had a higher rate of gag reflexes than medically compromised patients (13.4%).²² As most oral and dental treatments can trigger the gag reflex, it is very important to know about the gag reflex and its associated or causative factors. To our knowledge, no case-control study has examined the relationship between soft palatal types and the gag reflex; however, only a single cross-sectional study has been conducted in Saudi Arabia to

determine the association between the gag reflex and soft palate types.²⁰ Therefore, this case-control study was conducted to assess the association between types of soft palate and gag reflex among a sample of dental patients in our society.

METHODOLOGY

This case-control study was conducted at the Prosthodontics Department of Khyber College of Dentistry, Peshawar, Pakistan, from 21st August 2025 to 23rd January 2026. The STROBE checklist was used to report the study's main findings. The study was conducted in full accordance with the World Medical Association Declaration of Helsinki. Ethical approval was obtained from the Institutional Research Review Board (70/RRB/KCD dated 11-August 2025). Non-probability, consecutive sampling technique was used. The null hypothesis was that there was no association between the type of soft palate and gag reflex. The sample size was calculated using Open Epi sample size calculator, considering 35.7% gag reflex in healthy compared to 13.4% gag reflex in medically compromised patients, having Odds ratio of 0.29, with 95% confidence interval, $\alpha \leq 0.05$, with power 80% and unexposed/exposed ratio = 1.²² The sample size calculated was 120 (with 60 cases and 60 controls). Inclusion criteria included patients aged 20 to 60 years who came for treatment with any prosthesis (removable partial denture, fixed partial denture, complete denture, and/or stabilizing splint) for which impression recording was necessary. Exclusion criteria included psychological ailment, patients with cleft/lip palate, any muscle dystrophy, having any systemic disease, palatopharyngeal incompetency, any oral pathology, any dental tissue trauma, and /or nasal obstruction. The patients for this study were selected based on the inclusion and exclusion criteria. The patients were briefed about the research. Verbal informed consent to participate in this study was obtained. Each patient was seated in a dental chair in an upright position, with his head against the headrest, facing the dentist, and his legs straight. The patients were examined using a mouth mirror by gently moving it from the anterior palatal region to the junction of the hard and soft palates to trigger the gag reflex. After that, a proper-sized tray was selected. The Alginate impression material was mixed according to the manufacturer's instructions. The mixed material was loaded in the selected tray. Impressions of the upper arch were recorded to assess the gag reflex and to obtain a cast for measurement to determine the type of soft palate according to House classification.²³ Based on angular relationship formed by soft palate with hard palate, soft palate is classified as "type I": broad and normal with a

band of 5-12 mm resilient tissue posterior to the line between tuberosities which is almost horizontal or turns down from the hard palate gently at angle $<10^\circ$; "type II": about 3-5 mm resilient tissue posterior to the line between tuberosities which turns down from the hard palate at angle $10-45^\circ$; and "type III": about 2-3 mm resilient tissue anterior to the line between tuberosities which turns down sharply from the hard palate at angle $>45^\circ$. The severity of the gag reflex was assessed through the Dickinson and Fiske gagging severity index.²⁴ Grade 1 was considered to have no abnormal gag reflex. Grade 2 was considered mild, Grade 3 moderate, and Grades 4 & 5 as severe gag reflex. Patients who experienced gagging during impression recording and during mirror movement in the palatal region were considered cases, and those who did not were selected as controls. Demographic and general information were recorded in a structured proforma. Based on education, patients were divided into 5 groups: group 1 with no education; group 2 with up to primary education; group 3 with up to middle education; group 4 with up to SSC; and group 5 with HSSC or above. Concerning age, the patients were divided into four age groups, i.e., Group I = 20-30 years, Group II=31-40 years, Group III = 41-50 years, and Group IV = 51-60 years. The data was analyzed using SPSS version 23. Independent variables were age, gender, education, soft palate type, motion sickness, mouth breathing, and Gastro-Esophageal Reflux Disease (GERD). The dependent variable was the gag reflex. The mean and standard deviation were determined for a scale variable, such as age. Frequency and percentages were calculated for categorical variables, including age groups, gender, types of soft palate, mouth breathing, motion sickness, GERD, and severity of gag. Odds ratio with 95% confidence interval was used to assess the association between the gag reflex and types of soft palate. The chi-square test was used to assess the association between gender, age group, motion sickness, mouth breathing, and GERD and the gag reflex. A binary logistic regression model was also applied to identify the study variables that were predictive of the gag reflex.

RESULTS

A total of 120 patients were enrolled in this study, divided into two groups: 60 cases and 60 controls. The patients' ages ranged from 20 to 60 years, with a mean of $41.9 (\pm 14)$. The mean age of patients in the case and control groups was $41.8 (\pm 13.5)$ and $42 (\pm 14.7)$, respectively. Of 120 patients, 39.2% were male, and 60.8% were female (Table 1). The numbers of males and females were almost the same in the case group as in the control group (Table 3). Among controls ($n=60$),

the frequency of soft palate type I was 66.7% ($n=40$), type II was 30% ($n=18$) and type III was 3.30% ($n=2$) while among the cases ($n=60$), soft palate type I was 28.3% ($n=17$), type II was 63.3% ($n=38$) and type III was 8.3% ($n=5$) (table 3). Among cases, according to the Gag Reflex Severity Index, grade II (mild) was 86.66% ($n=52$), grade III (Moderate) was 7 (11.6%), and grade IV (Severe) was 1 (1.66%), respectively (Table 2). Chi-square analysis shows a significant association between soft palate type and gag reflex ($\text{Chi}^2 < 0.05$; table 3). Compared to the control, the odds of being palatal type II are 4.97 (95% C.I., 2.24-11) times greater than in gag reflex patients, and also, compared to the control, the odds of being palatal type III are 5.88 (95% C.I., 1-33.36) times greater than in gag reflex patients. Binary logistic regression analysis was applied, using the gag reflex as the dependent variable and age, gender, education, motion sickness, GERD, mouth breathing, and palatal type form as independent variables. The model was suitable, and the Hosmer-Lemeshow test was adequate (Table 4).

Table 1: Characteristics of Patients Who Participated

Parameters	Frequency (%)
Age groups	
20-30 years	36 (30%)
31-40 years	24 (20%)
41-50 years	21 (17.5%)
51-60 years	39 (32.5%)
Gender	
Male	47 (39.2%)
Female	73 (60.8%)
Education	
No education	61 (50.8%)
Primary	07 (5.8%)
Middle	09 (7.5%)
Matric	11 (9.2%)
FSc	14 (11.7%)
Bachelor's or higher	18 (15%)
Motion sickness	
No	92 (76.7%)
Yes	28 (23.3%)
GERD	
No	91 (75.8%)
Yes	29 (24.2%)
Breathing during sleep	
Through Nose	86 (71.7%)
Through Mouth	34 (28.3%)
Palatal types	
Type I	57 (47.5%)
Type II	56 (46.7%)
Type III	07 (5.8%)

Table 2: Frequency Distribution of Gag Reflex Severity in the Case Group

Gag severity	Frequency	%age
Mild gag	52	86.66 %
Moderate gag	07	11.66 %
Severe gag	01	1.66 %

Table 3: Cross-Tabulation of Gag Reflex with Age, Gender, Education, Motion Sickness, Gerd, Breathing, and Palatal Type.

Parameters		Case or Control		P value (chi-square)
		Control	Case	
Age groups				0.379
20-30 years	19	17		
31-40 years	12	12		
41-50 years	07	14		
51-60 years	22	17		
Gender				0.575
Male	25	22		
Female	35	38		
Education				0.179
No education	37	24		
Primary	02	05		
Middle	05	04		
Matric	03	08		
HSSC	06	08		
Bachelor's or higher	07	11		
Motion sickness				0.001
No	54	38		
Yes	06	22		
GERD				0.000
No	55	36		
Yes	05	24		
Breathing during sleep				0.005
Through Nose	50	36		
Through Mouth	10	24		
Palatal types				0.000
Type I	40	17		
Type II	18	38		
Type III	02	05		

Table 4: Binary Logistic Regression Analysis Showing Odds Ratios and Confidence Intervals of Gag about Age, Gender, Education, Motion, Gerd, Breathing Pattern, and Palatal Type

Variables		Crude Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	p-value
Age groups	Group 1		REF Value 1.0	
	Group 2	1.12 (0.39-3.14)	1.51 (0.396-5.76)	0.547
	Group 3	2.24 (0.73-6.84)	3.88 (0.81-18.6)	0.090
	Group 4	0.864 (0.35-2.15)	2.17 (0.566-8.32)	0.258
Gender	Male		REF Value 1.0	
	Female	1.23 (0.59-2.57)	3.6 (1.1-11.75)	0.036
Education	No education		REF Value 1.0	
	Primary	3.9 (0.69-21.49)	7.5 (0.869-65.3)	0.067
	Middle	1.23 (0.30-5.1)	1.323 (0.197-8.87)	0.773
	Matric	4.11 (0.99-17.1)	7.48 (1.09-51.22)	0.041
	HSSC	2.1 (0.63-6.7)	2.089 (0.471-9.27)	0.333
	Bachelor's or above	2.4 (0.82-7.12)	2.112 (0.438-10.193)	0.352
Motion sickness	No		REF Value 1.0	
	Yes	5.21 (1.91-14.07)	4.96 (1.54-15.99)	0.007
GERD	No		REF Value 1.0	
	Yes	7.33 (2.56-20.98)	5.55 (1.63-18.91)	0.006
Breathing	Nose		REF Value 1.0	
	Mouth	3.33 (1.42-7.82)	2.57 (0.86-7.69)	0.091
Palate Type	Type I		REF Value 1.0	
	Type II	4.97 (2.23-11.03)	2.97 (1.048-8.432)	0.041
	Type III	5.88 (1.04-33.35)	8.004 (0.984-65.122)	0.05

DISCUSSION

Gag reflex is often a problem for dentists during dental procedures, hindering or even preventing them from being performed. This study aimed to investigate the association between soft palate type and the gag reflex in patients during impression recording with Sodium alginate. In the present study, among the case group, a mild gag reflex was most common (86.7%), followed by moderate (11.6%), while severe (1.7%) was least common. These findings align with those of Halboub E and Qamar K.^{20,25} Regarding soft palate morphology, among controls, type I was 66.7%, followed by type II (30%) and type III (3.3%). Similar findings were also observed by Qamar K et al., who found soft palate type I=60%, type II=31.6%, and type III=3.3%.²⁵ However, among cases (gag group), soft palate type I was 28.3%, type II was 63.7%, and type III was 8.3%, which contrasts with the study by Khan SU.²⁶ The association between gag reflex severity and

soft palate type was highly significant ($p < 0.001$) (Table 3). These observations are consistent with Halboub et al. and Qamar K., who reported a significant correlation between soft palate type and gagging.^{20, 25} In this study, no association between gender and the gag reflex was found, which is consistent with Muhammad Kamran and Hiroyuki Karibe. However, in contrast to the studies of Alamgir, Halboub E, and Qamar K, where they found an association of gender with gag reflex and according to them a higher proportion of females experienced gag compared to males, In the present study, the association between age groups and the gag reflex was found to be insignificant ($p = 0.379$).^{13, 20, 25} Similar findings were reported by Halboub E and Qamar K, who found no significant association between age groups and gagging.^{20,25} There was a significant association between motion sickness, GERD, mouth breathing, and the gag reflex. The binary logistic regression analysis suggests that, for every unit increase in soft palate type II and type III, the odds of increased

gag reflex were 3 and 8 times, respectively (Table 4). There are various methods for managing the gag reflex. Gag reflex can be managed either by pharmacological or non-pharmacological means.²⁷ Local anesthetics, general anesthesia, sedatives, and herbal medications are examples of pharmacological approaches. As a preventive measure, Rabemac-DSR (rabeprazole 20 mg and domperidone 30 mg sustained release) can be prescribed orally 1 h prior to the final impression making for effective prevention of nausea and vomiting.²⁸ Non-pharmacological techniques such as behavioral therapy, hypnosis, acupuncture, distraction and laser therapy are also mentioned.²⁹ Digital impression or the intra-oral scanning might be the best option in this matter.³⁰ In certain instances, a lack of a gag reflex may be a symptom of a more severe medical condition, such as cranial nerve damage or brain death.³¹ A larger sample with more participants with a severe gag reflex would enable a stronger association of the gag reflex with other covariates.

LIMITATIONS

The limitation was the small sample size, which may have undermined the study's power to detect differences/associations and limited the generalizability of the results. Secondly, with the above study procedure, we were able to trigger a somatogenic type of gag reflex; hence, the Psychogenic type of gag reflex was out of scope for this study.

CONCLUSIONS

According to this study, soft palate type is significantly associated with the gag reflex. The gag reflex is also more common in patients with motion sickness, GERD, and mouth breathing.

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AUTHORS CONTRIBUTION

Shafi Ullah Khan - Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Critical Revision; Supervision; Final Approval

The authors accept responsibility for all aspects of the work and will ensure that any concerns regarding the accuracy or integrity of any part are properly investigated and resolved.



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