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The possible association between the types of soft palate and gag reflex: a preliminary study

A possível associação entre os tipos de palato mole e o reflexo de vômito: um estudo preliminar

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ABSTRACT

Objective: whether gag reflex, a common problem encountered during dental procedures, is associated with the different types of the soft palate has not been addressed so far. This preliminary study sought to assess the potential association between the different types of soft palate and gag reflex. **Material and Methods:** one hundred dental patients were recruited. The type of soft palate was determined. Subjective (self-reported) gag reflex was recorded based on many questions and past experience and on a 0-6 VAS. Objective assessment of gag reflex was done using different maneuvers where the posterior part of the tongue and the soft palate were touched by dental mirror, and by taking impression for the upper arch. The association between the types of soft palate and the subjective and objective recorded gag reflex were statistically tested. **Results:** there were 53 (53%), 33 (33%) and 14 (14%) of the participants with class I, class II and class III soft palate, respectively. A significant association was found between the type of the soft palate and gag reflex in response to one of the subjective items (P= 0.039), more prominent among females (P= 0.009). Concerning the objective assessment, no significant associations were found among males. Meanwhile more females with class II and class III suffered gag reflex and/or actual gagging upon taking the impression (P = 0.001). **Conclusion:** this study illustrated an association between the type of soft palate and gag reflex, and its severity in females (more specifically soft palate types II and III) more than in males.

KEYWORDS

Gag reflex; Soft palate; Dental materials; Prosthodontics; Restorative dentistry.

RESUMO

Objetivo: o reflexo de vômito, um problema comum encontrado durante procedimentos odontológicos, está ou não associado aos diferentes tipos de palato mole, não foi ainda abordado até o momento. Este estudo preliminar procurou avaliar a possível associação entre os diferentes tipos de palato mole e o reflexo de vômito. **Material e Métodos:** cem pacientes odontológicos foram recrutados. O tipo de palato mole foi determinado. O reflexo de vômito subjetivo (auto-relatado) foi registrado com base em muitas perguntas e experiências anteriores e em um VAS de 0-6. A avaliação objetiva do reflexo de vômito foi feita por meio de diferentes manobras onde a parte posterior da língua e o palato mole foram tocados por espelho dental e por meio de moldagem da arcada superior. A associação entre os tipos de palato mole e o reflexo de vômito subjetivo e objetivo registrado foi testada estatisticamente. **Resultados:** houve 53 (53%), 33 (33%) e 14 (14%) participantes com palato mole classe I, classe II e classe III, respectivamente. Foi encontrada associação significativa entre o tipo de palato mole

e o reflexo de vômito em resposta a um dos itens subjetivos (P= 0,039), mais proeminente no sexo feminino (P= 0,009). Em relação à avaliação objetiva, não foram encontradas associações significativas entre os homens. Enquanto isso, mais mulheres com classe II e classe III sofreram reflexo de vômito e/ou engasgo real ao receber a impressão (P = 0,001). **Conclusão:** este estudo ilustrou uma associação entre o tipo de palato mole e reflexo de vômito e sua gravidade em mulheres (mais especificamente palato mole tipos II e III) mais do que em homens.

PALAVRAS-CHAVE

Ânsia de vômito; Palato mole; Materiais dentários; Prótese dentária; Dentística.

INTRODUCTION

The gag reflex, also known as the pharyngeal reflex, is a reflex contraction of the muscles of the posterior pharynx after stimulation of the posterior pharyngeal wall, tonsillar area, or base of the tongue. It is believed to be an involuntary defense mechanism to protect the pharynx and throat from unwanted objects and prevent the aspiration of solid food particles [1,2]. Gagging is a common problem experienced during dental procedures. Dentist routinely faces patients with gag reflex in daily practice who need extra management maneuvers in order to avoid exacerbating of such a situation [2].

Individuals with severe gag reflex have poor oral health status. That is because they have difficulty in brushing their posterior teeth. Thus, these teeth are more susceptible to dental caries and gingival bleeding. Moreover, it has been reported that individuals with gag reflex had higher number of missing teeth than those without a severe gag reflex [3]. It is necessary for dentists to identify the gag reflex of their patients before starting any diagnostic or therapeutic dental procedures. This will allow the dentist to manage the problem correctly and effectively. Although the prevalence of gag reflex is not exactly well known, van Houtem et al. [3] reported a prevalence of 8.2% of self-reported gag reflex. The actual or problematic gagging was found to be 10-25% in another study carried out by Sewerin [4] during intra-oral radiographic procedures. Randall et al. [5], however, reported a prevalence of 7.5% of high frequent problematic gagging during dental procedures in the dental clinics.

The soft palate is considered one of the trigger points of gag reflex. It is a mobile muscular fold suspended from the posterior border of the hard palate, sloping down and back between the oral and nasal parts of the pharynx. Unlike the hard palate, the soft palate doesn't contain a bony framework. Rather, it consists of the aponeurotic and muscular tissue. Moreover, the soft palate contains neurovascular structures and many mucous glands that lubricate the oral cavity [1,6]. The function of the soft palate is to facilitate speech, breathing and swallowing by making sure that the proper communication channels between the oral, pharyngeal and nasal cavities are open or closed during each of these processes. The soft palate is an important part in the oral cavity that should be taken into consideration in the daily dental practice, particularly when dealing with dentures and dental impressions. It forms the posterior palatal seal of the denture. Any extension beyond this resilient tissue will result in dislodgement of the denture, speech difficulty, inflammation of the extension area, or gag reflex.

To the best of our knowledge, there has not a single study so far linked specific types of soft palate to the occurrence of gag reflex. Therefore, this preliminary study sought to assess the potential association between the different types of soft palate and gag reflex among a sample of Saudi dental patients.

MATERIAL AND METHODS

This preliminary cross-sectional study was conducted at College of Dentistry, Jazan University, Jazan, Saudi Arabia. It was approved by the Standing Committee for Scientific Research Ethics, Jazan University (REC41/1-005). It was also conducted in strict compliance with the Helsinki Declaration on medical research involving human subjects. Study's potential risks and benefits were explained to all participants and written informed consents were obtained accordingly.

As this study was preliminary and exploratory, the sample size was not prior-calculated. Rather, a

convenience sample of 100 participants (50 males and 50 females) who fit the inclusion criteria was recruited. The participants were ordinary attendants of the dental clinics. The subjects with the following criteria were excluded: 1) cleft lip/palate; 2) palatopharyngeal incompetency; 3) history of oral and/or maxillofacial trauma, surgery or pathology; and 4) wearing removable dentures or obturators.

The data collected were divided into two parts: patient's part (subjective/self-reported) and dentist's part (objective). In the "patient's part", each participant was interviewed using structured questionnaire including the following: age, gender, occupation, in addition to certain other questions about the participant's past experience regarding gag reflex (The asked questions were included in Tables I-II for more

Table I - Self-reported gag reflex among all subjects by soft palate types

Variable		Whole sample			
		Type I	Type II	Type III	P-value
Do you have a gag reflex?; yes responses		10 (34.5)	12 (41.4)	7 (24.1)	0.039[a]
Have you ever had a negative incident with gag reflex?; yes responses		7 (41.2)	7 (41.2)	3 (17.6)	0.563[a]
Have you ever had gagged at dentist's office before?; yes responses		5 (31.3)	7 (43.7)	4 (25.0)	0.134[a]
Have daily activities like brushing and flossing your teeth ever made you gag?; yes responses		11 (40.7)	11 (40.7)	5 (18.5)	0.323[a]
How do you feel when you brush your back teeth?	No nausea	36 (56.3)	19 (29.7)	9 (14.1)	0.552[a]
	Slight nausea	16 (48.5)	13 (39.4)	4 (12.1)	
	I am afraid I will vomit	0 (0.0)	1 (50.0)	1 (50.0)	
	I can't do it because I immediately feel nauseated and fell vomiting	1 (100.0)	0 (0.0)	0 (0.0)	
How do you feel when dentist is working on your back teeth?	No nausea	40 (58.8)	20 (29.4)	8 (11.8)	0.565[a]
	Slight nausea	11 (40.7)	11 (40.7)	5 (18.5)	
	I am afraid I will vomit	2 (40.0)	2 (40.0)	1 (20.0)	
Severity of gag reflex; *Mean±SD*		1.57±1.62	1.97±1.99	2.86±2.48	0.075[b]

[a]Chi-squared test was used; [b]ANOVA test was used; P-value < 0.05 is considered significant.

Table II - Self-reported gag reflex among both genders by soft palate types

Variable		Males				Females			
		Type I	Type II	Type III	P-value	Type I	Type II	Type III	P-value
Do you have a gag reflex?; *yes responses*		4 (36.4)	4 (36.4)	3 (27.3)	0.619[a]	6 (33.3)	8 (44.4)	4 (22.2)	0.009[a]
Have you ever had a negative incident with gag reflex?; *yes responses*		3 (50.0)	3 (50.0)	0 (0.0)	0.444[a]	4 (36.4)	4 (36.4)	3 (27.3)	0.058[a]
Have you ever had gagged at dentist's office before? ; *yes responses*		4 (40.0)	3 (30.0)	3 (30.0)	0.543[a]	1 (16.7)	4 (66.7)	1 (16.7)	0.064[a]
Have daily activities like brushing and flossing your teeth ever made you gag?; *yes responses*		5 (41.7)	3 (25.0)	4 (33.3)	0.265[a]	6 (40.0)	8 (53.3)	1 (6.7)	0.062[a]
How do you feel when you brush your back teeth?	No nausea	16 (48.5)	12 (36.4)	5 (15.2)	0.658[a]	20 (64.5)	7 (22.6)	4 (12.9)	0.476[a]
	Slight nausea	7 (46.7)	5 (33.3)	3 (20.0)		9 (50.0)	8 (44.4)	1 (5.6)	
	I am afraid I will vomit	0 (0.0)	1 (50.0)	1 (50.0)		0 (0.0)	0 (0.0)	0 (0.0)	
	I can't do it because I immediately feel nauseated and fell vomiting	0 (0.0)	0 (0.0)	0 (0.0)		1 (100.0)	0 (0.0)	0 (0.0)	
How do you feel when dentist is working on your back teeth?	No nausea	18 (51.4)	12 (34.3)	5 (14.3)	0.383[a]	22 (66.7)	8 (24.2)	3 (9.1)	0.193[a]
	Slight nausea	3 (25.0)	5 (41.7)	4 (33.3)		8 (53.3)	6 (40.0)	1 (6.7)	
	I am afraid I will vomit	2 (66.7)	1 (33.3)	0 (0.0)		0 (0.0)	1 (50.0)	1 (50.0)	
Severity of gag reflex; *Mean±SD*		1.00±1.65	1.11±1.71	2.33±2.55	0.179[b]	2.00±1.49	3.00±1.85	3.80±2.28	0.039[b]

[a]Chi-squared test was used; [b]ANOVA test was used; P-value < 0.05 is considered significant.

details). The self-reported severity of gag reflex was scored on Analogue Visual Scale (AVS) measuring 0 to 6, where zero means no gag reflex at all, and 6 means sever gag reflex or even actual gagging.

In the "dentist's part", the type of soft palate was first determined based on House's classification. On the basis of 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°; "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°; 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° [7-9]. Figure 1 shows the different types of soft palate. For this purpose, the examiners (BS, SJ, GA, TA, and AK) were trained well and calibrated under the supervision of a specialist in prosthodontics (BA). The training was conducted on 30 volunteering dental students and the specialist explained to the trainees (examiners) the criteria of determining each type of the soft palate. One week later, the trainees examined these students again and a consensus on the type of the soft palate was in absolute agreement with the previous results.

For the purpose of the current study, each participant was examined by two of the examining authors, and the type of soft palate was decided by agreement. The examiners assessed the gag reflex using different maneuvers: 1) Touching the soft palate by a dental mirror while the participant is opening his/her mouth in a relaxed position; 2) Touching the soft palate by a dental mirror while the participant is opening his/her mouth and say 'AAAAAH'; 3) Touching the posterior part of the tongue by a dental mirror while the participant is opening his/her mouth in a relaxed position; and 4) Touching the posterior part of the tongue by a dental mirror while the participant is opening his/her mouth and say 'AAAAAH.'

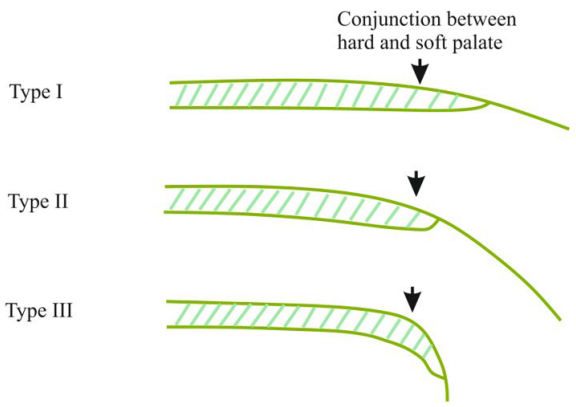

Figure 1 - The different types of soft palate.

The examiners also assessed the gag reflex upon taking impression for the upper arch. In brief, alginate impression (Cavex CA37, The Netherland) was mixed according to the manufacturer's instructions and immediately loaded into a plastic impression tray which was then inserted into the patient's mouth. The reactions of the participants were recorded as: no gag; gag reflex or actual gagging.

Raw data were input into excel file from which they were imported into SPSS for Windows version 25 (IBM, Armonk, NY, USA). The qualitative variables were presented as frequencies and proportions, while the quantitative variables were presented as means and standard deviations. The potential associations between any two of the qualitative variables were tested using Chi-square, while the potential differences in any quantitative variables by gender were tested using independent t-test. The differences in quantutative variable by type of soft palate was tested using ANOVA. A p value of < 0.05 was considered significant.

RESULTS

The mean age of the participants was 26.99±5.92 years. The males were significantly younger (25.58±2.65 vs. 28.4±7.73; P = 0.001). Up to 44% of the participants were students, and 18% were housewives. There were 53 (53%), 33 (33%) and 14 (14%) of the participants with type I, type II and type III soft palate, respectively, with no significant difference distribution by gender.

The subjective (self-reported) gag reflex is presented in Tables I-II. Concerning the whole sample (Table I), significant association was found between the different types and gag reflex in terms of response to "having gag reflex" question (P= 0.039), with 41.4% of type II participants reported having gag reflex. Similarly, but insignificantly, higher

percentage among type II participants (P= 0.134) reported positive responses concerning their previous experience of gag reflex in dental office. Although not statistically significant, type III participants reported higher severity of gag reflex (2.86±2.48) than other classes did (1.57±1.62 and 1.97±1.99 for types I and II soft palate, respectively, P = 0.075; Figure 2).

Taking individual genders, no significant associations/differences were found in all self-reported questions for male participants (P > 0.05). Contrarily, higher proportions of females with type II (44.4%) compared to types I and III types of soft palate (34.5% and 24.1%, respectively) reported having gag reflex (P= 0.009; Table II). Moreover, the self-reported severity of gag reflex was significantly higher for females with types III and II soft palate (3.80±2.28 and 3.00±1.85, respectively) compared to females with types I soft palate (2.00±1.49, P= 0.039; Figure 2).

The results of the objective assessment of the gag reflex are presented in Tables III-IV. Concerning the whole sample, no significant associations/differences were found between the different classes of soft palate and the recorded gag reflex in terms of all maneuvers applied (P > 0.05) despite that participants with type II soft palate exhibited more actual gagging than did the participants with other types of soft palate (Table III).

Taking individual genders, 48% of females with class II suffered gag reflex and 100% of females with type III suffered actual gagging upon taking the impression (P= 0.001). No significant associations were found among male participants between the type of soft palate and objectively-reported gag reflex (Table IV).

DISCUSSION

Despite the advances in dentistry, gagging is a common problem faced by dental practitioners during dental procedures, which makes the therapeutic procedures difficult or even

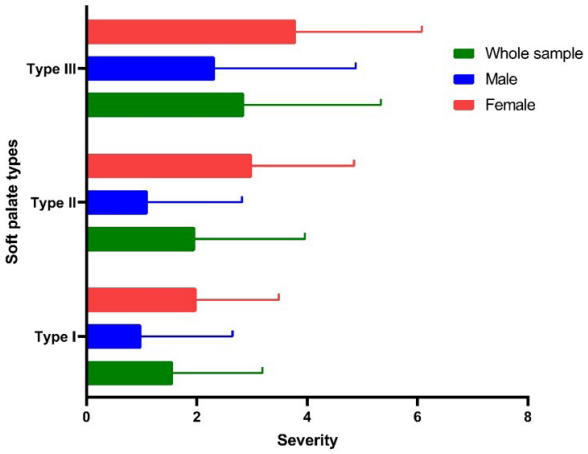

Figure 2 - Severity of gag reflex for the whole sample and according to gender.

Table III - Gag reflex measurement methods among all subjects by soft palate classes

Variable		Whole sample			
		Class I	Class II	Class III	P-value
Touching the soft palate by a mirror while the subject is opening his/her mouth in a relaxed position	No gag	39 (55.7)	20 (28.6)	11 (15.7)	0.513[a]
	Gag reflex	14 (46.7)	13 (43.3)	3 (10.0)	
	Actual gagging	0 (0.0)	0 (0.0)	0 (0.0)	
Touching the soft palate by a mirror while the subject is opening his/her mouth and say 'AAAAAH'	No gag	36 (58.1)	17 (27.4)	9 (14.5)	0.307[a]
	Gag reflex	17 (44.7)	16 (42.1)	5 (13.2)	
	Actual gagging	0 (0.0)	0 (0.0)	0 (0.0)	
Touching the posterior part of the tongue by a mirror while the subject is opening his/her mouth in a relaxed position	No gag	40 (54.8)	23 (31.5)	10 (13.7)	0.748[a]
	Gag reflex	12 (50.0)	8 (33.3)	4 (16.7)	
	Actual gagging	1 (33.3)	2 (66.7)	0 (0.0)	
Touching the posterior part of the tongue by a mirror while the subject is opening his/her mouth and say 'AAAAAH'	No gag	38 (57.6)	19 (28.8)	9 (13.6)	0.548[a]
	Gag reflex	14 (45.2)	12 (38.7)	5 (16.1)	
	Actual gagging	1 (33.3)	2 (66.7)	0 (0.0)	
Gag reflex while taking impression	No gag	36 (65.5)	13 (23.6)	6 (10.9)	0.080[a]
	Gag reflex	16 (38.1)	19 (45.2)	7 (16.7)	
	Actual gagging	1 (33.3)	1 (33.3)	1 (33.3)	

[a]Chi-squared test was used; P-value < 0.05 is considered significant.

Table IV - Gag reflex measurement methods among both genders by soft palate classes

Variable		Males				Females			
		Class I	Class II	Class III	P-value	Class I	Class II	Class III	P-value
Touching the soft palate by a mirror while the subject is opening his/her mouth in a relaxed position	No gag	18 (46.2)	14 (35.9)	7 (17.9)	0.999[a]	21 (67.7)	6 (19.4)	4 (12.9)	0.101[a]
	Gag reflex	5 (45.5)	4 (36.4)	2 (18.2)		9 (47.4)	9 (47.4)	1 (5.3)	
	Actual gagging	0 (0.0)	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	0 (0.0)	
Touching the soft palate by a mirror while the subject is opening his/her mouth and say 'AAAAAH'	No gag	19 (47.5)	14 (35.0)	7 (17.5)	0.913[a]	17 (77.3)	3 (13.6)	2 (9.1)	0.064[a]
	Gag reflex	4 (40.0)	4 (40.0)	2 (20.0)		13 (46.4)	12 (42.9)	3 (10.7)	
	Actual gagging	0 (0.0)	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	0 (0.0)	
Touching the posterior part of the tongue by a mirror while the subject is opening his/her mouth in a relaxed position	No gag	16 (43.2)	14 (37.8)	7 (18.9)	0.609[a]	24 (66.7)	9 (25.0)	3 (8.3)	0.304[a]
	Gag reflex	6 (60.0)	2 (20.0)	2 (20.0)		6 (42.9)	6 (42.9)	2 (14.3)	
	Actual gagging	1 (33.3)	2 (66.7)	0 (0.0)		0 (0.0)	0 (0.0)	0 (0.0)	
Touching the posterior part of the tongue by a mirror while the subject is opening his/her mouth and say 'AAAAAH'	No gag	18 (46.2)	14 (35.9)	7 (17.9)	0.746[a]	20 (74.1)	5 (18.5)	2 (7.4)	0.086[a]
	Gag reflex	4 (50.0)	2 (25.0)	2 (25.0)		10 (43.5)	10 (43.5)	3 (13.0)	
	Actual gagging	1 (33.3)	2 (66.7)	0 (0.0)		0 (0.0)	0 (0.0)	0 (0.0)	
Gag reflex while taking impression	No gag	18 (54.5)	11 (33.3)	4 (21.1)	0.293[a]	18 (81.8)	2 (9.1)	2 (9.1)	0.001[a]
	Gag reflex	4 (26.7)	6 (40.0)	5 (33.3)		12 (44.4)	13 (48.1)	2 (7.4)	
	Actual gagging	1 (50.0)	1 (50.0)	0 (0.0)		0 (0.0)	0 (0.0)	1 (100.0)	

[a]Chi-squared test was used; P-value < 0.05 is considered significant.

impossible to perform [10]. This preliminary study aimed to investigate the relationship between different types of soft palate and the occurrence of gag reflex by subjective method (using interview questionnaire) and objective method (through touching by dental mirror and by taking impression).

In our study, the score of the severity of gag reflex reported by female patients was significantly higher than that of males and significantly more frequently in type II and III soft palate than in type I. This can be ascribed to the higher tolerance of gag reflex by males despite the type of the soft palate, and a lower tolerance of gag reflex by females which accentuated more in type III followed by type II; females with type I revealed lower frequency of gagging. Irrespective of the type of soft palate, which has not been assessed so far in relation to the gag reflex, our results, higher gag reflex among females, agree with the results of van Houtem et al. [3] study, but disagree with the results reported by Karibe et al. [1] and Akarslan and Bicer [11].

The sensitivity of different sites of the oral cavity along with the ability of patients to withstand intraoral stimuli varies greatly. There are five intraoral areas known as "trigger zones" at which the gag reflex is normally triggered, namely: the palatoglossal and palatopharyngeal folds, base of the tongue, soft palate, uvula, and posterior pharyngeal wall [12]. We manipulated two of these intraoral areas (base of the tongue and soft palate) that are considered the most excitable and accessible areas by different dental procedures. The manipulation was carried using dental mirror in two different physiologic situations: while the participant was relaxed so these areas are not contracted, and while the subject saying "AAAAAH" so these structures are in function (contracted). In addition to the touching by the dental mirror, we took impression for the upper arch. Indeed, among the dental triggering that may cause gagging, taking dental impressions of the upper arch is the most problematic. Actually most of the participants suffered difficulties during this procedure [13]. Thus, the manipulations that we applied can be trusted and be valid as objective assessment procedures of gag reflex.

Treating such a group of patients (who frequently experience gag reflex) can be stressful and a time-consuming experience, both for the dentist and the patient. Hence, this type of patient need special considerations. Management of the patient with gagging depends on the severity of the problem. A dentist can perform dental treatment of a patient with a mild to moderate gag reflex in his/her clinic in general dental practice.

However, the patients with severe gag reflex should be referred to a special clinic or hospital which has equipment required for the treatment. Behavioral approaches, complementary medicine therapies and pharmacological techniques are used for the treatment of problematic gagging in dentistry. The issue of managing dental patient with gag reflex has been extensively reviewed elsewhere [2] and even different techniques have been innovated in this context [14]. Digital impression or the intra-oral scanning might be the best option in this matter [15,16].

The study has cons and pros. One of the strength points of this study was using the same type and amount of impression materials and the same water temperature, along with the standardized position of the subjects while applying the different testing procedures. Furthermore, the study included equal numbers of female and male patients.

One major limitation of the study is that we didn't assess the reliability of the objective assessment of the types of soft palate. However, we confirm that the examiners were trained well under supervision of a specialist in prosthodontics, in addition to the fact that all subjects were assessed by two of the trained authors and the assessment was thus recorded upon consensus. Another limitation was the small sample size and hence number of subjects with type III soft palate was very small owing to the fact it is less prevalent than types I and II soft palate. Also due to the small sample size, the number of participants who reported subjective gag reflex, or who objectively found to experience gag reflex was small too. Such a limitation may undermine the power of the study to detect differences/associations and limit the generalizability of the results. Therefore, our results can be considered preliminary, and thus further well-designed, large-scale studies are highly encouraged.

CONCLUSION

This study illustrated an association between the type of soft palate and the occurrence of gag reflex and its severity in females more than in males. Females with type II and III soft palate are more prone to gag reflex than females with type I soft palate, and even than males irrespective of their type of soft palate. The dental practitioners are required to take care of the various types of the soft palate especially among females.

Author's Contributions

EH, BMA: Designing the Study, Interpretation of the Data, Drafting the Manuscript. BAS, SAJ, GKA, TMA, AHK: Data Collection, Drafting the Manuscript. MNA: Statistical Analysis, Drafting the Manuscript. All authors read and approved the final manuscript.

Conflict of Interest

No conflicts of interest declared concerning the publication of this article.

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Regulatory Statement

This study was conducted in accordance with all the provisions of the local human subjects oversight committee guidelines and policies of: Standing Committee for Scientific Research Ethics, Jazan University.

The approval code for this study is: REC41/1-005.

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