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Prevalence of Gagging in Children and the Association Between Gagging and Dental Fear: A Cross-Sectional Study

Çocuklarda Öğürme Refleksi Prevalansı ve Dental Korkunun Öğürme Refleksi Üzerine Etkisi: Kesitsel Araştırma

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ABSTRACT Objective: Gagging is a crucial problem that is frequently experienced during dental treatments and affects the success of the treatment. The aim of this study was to determine the frequency of gagging in children and search the impact of dental fear on gagging. **Material and Methods:** In this study, 417 volunteer patients aged 6-14 years who had previous dental experience and applied to our clinic for treatment were included. In order to assess fear prior to examination, patients were requested to fill a form including the Children's Fear Survey Schedule-Dental Subscale. Then, an experienced dentist recorded the extent of gagging pursuant to the Classification of Gagging Problem index through the examination made to trigger points using the dental mirror. In the statistical evaluation, Mann-Whitney U, Kruskal-Wallis, and chi-square tests were used and the results for $p<0.05$ were considered statistically significant**. Results:** It was found that 29.5% of the participants experienced gagging. Regarding gagging, there was a significant difference between genders in favor of men, while a negative correlation was found between age groups. Gag reflex was observed in 15.7% of the patients with low dental fear, 60.2% of the patients with moderate dental fear, and 72.5% of patients with high dental fear ($p<0.05$). **Conclusion:** The prevalence of gagging in pediatric dentistry is high. It is seen that the level of dental fear of patients with severe and moderate gagging is higher than patients with mild and normal gagging.

Keywords: Gagging; prevalence; dental anxiety

ÖZET Amaç: Öğürme, diş tedavileri sırasında sıklıkla karşılaşılan ve tedavinin başarısını etkileyen önemli bir sorundur. Bu çalışmanın amacı, çocuklarda öğürme sıklığını belirlemek ve diş korkusunun öğürmeye etkisini araştırmaktır. **Gereç ve Yöntemler:** Kliniğimize tedavi için başvuran ve daha önce diş hekimliği deneyimi olan 6-14 yaşları arasında 417 hasta bu çalışmaya dâhil edildi. Hastalardan muayene öncesi dental korkuyu değerlendirmek için "Çocuk Korku Değerlendirme Skalası-Dental Alt Ölçeği"ni içeren bir form doldurmaları istendi. Daha sonra, deneyimli bir diş hekimi tarafından ağız içi aynası kullanılarak triger noktalara yapılan muayene ile "Öğürme Problem İndeksi Sınıflandırması"na göre öğürme derecesi kaydedildi. İstatistiksel değerlendirmede Mann-Whitney U, Kruskal-Wallis ve ki-kare testleri kullanılarak, $p<0,05$ için sonuçlar istatistiksel olarak anlamlı kabul edildi. **Bulgular:** Çalışmaya katılan çocukların muayene sonuçları değerlendirildiğinde, %29,5'inde öğürme görüldü. Öğürme sonuçlarında, erkeklerde cinsiyetler arasında anlamlı farklılık bulunurken, yaş grupları arasında negatif korelasyon bulundu. Düşük dental korkuya sahip olanların %15,7'sinde, orta derecede dental korkuya sahip olanların %60,2'sinde, yüksek derecede dental korkuya sahip hastaların ise %72,5'inde öğürme refleksi bulguları görüldü ($p<0,05$). **Sonuç:** Çocuk diş hekimliğinde öğürme prevalansı yüksektir. Şiddetli ve orta derecede öğürmesi olan hastaların dental korku düzeyinin hafif ve normal öğürmesi olan hastalara göre daha yüksek olduğu görülmektedir.

Anahtar Kelimeler: Öğürme; prevalans; dental kaygı

Gag reflex is a natural defense mechanism that prevents the passage of unwanted objects to the aspiratory system (trachea, larynx, and oropharyngeal airway).[1] Intraoral areas, posterior pharyngeal wall, palatoglossal and palatopharyngeal folds, palate, uvula and root of tongue known as "trigger zones" in the formation of the reflex.[2] With the stimulation of these points, the transmission of the cranial nerves (notably, the pharyngeal nerve) to the medulla oblongata with sensory neurons causes irregular and

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spasmodic motor impulses that create the gag reflex.[3] The proximity of the medulla oblongata and vasomotor-cardiac centers causes the gag reflex to be accompanied by increased salivation, increased heart rate, and sweating.[3,4] In addition, the thought of a bad experience can trigger the gag reflex due to neural network connections between the reflex center and the cerebral cortex.[5]

Patient cooperation is essential for diagnostic procedures and successful dental treatment in dentistry. Dental treatment of patients with mild gag reflex is completed by taking a series of preventive measures. In patients with severe gag reflex, placing intraoral films in the mouth and taking impressions, which are the basic steps required for diagnosis and treatment, may not be attained.[6-8] In some cases, even the contact of the examination instruments with the oral mucosa cannot be tolerated. Therefore, patients often delay their routine dental treatments and visit the dentist only in case of an emergency. According to one study, the reason for avoidance in approximately 20% of adults who avoid dental treatment is gagging.[7] Due to the difficulties experienced in tooth brushing, these patients having poor oral hygiene frequently experience tooth and gum diseases. Gagging during dental treatment was reported to be associated with poor oral hygiene in adults, while no relationship between gagging and brushing frequency, or between gagging and whether the child brushes their teeth alone was reported in a study involving children.[9,10]

There are studies in the literature discussing the treatment options of patients with gag reflex. In order to control this reflex during treatment procedures, behavioral techniques such as positioning, distraction, and relaxation are recommended. Topical anesthesia and local anesthetic medications are also frequently used in treatment protocols. Pharmacological techniques such as sedation and general anesthesia are recommended as a last resort when anti-gag reflex techniques fail.[7,11] However, in recent years, due to the ease of application in pediatric dentistry, complementary medicine applications such as acupressure or biostimulant laser acupuncture have been used to inhibit the gag reflex at certain points of the body.[8,12]

Although there are studies on the treatment of gagging in dental treatments, there are limited studies investigating the relationship between the gagging and dental fear. Although many dentists working in pediatric patients in Türkiye detect gag reflex, its prevalence has not been investigated in the Turkish population. The aim of this study was to investigate the prevalence of gag reflex and its relationship with dental fear in pediatric dentistry.

MATERIAL AND METHODS

Approval for the present study was obtained from the Ethics Committee of Gazi University (decision date and number: July 26, 2019/08, research number: 2019-236). In addition, this study was conducted in accordance with the principles of the Declaration of Helsinki. Patients aged 6-14 years, with dental experience and who agreed to participate in the study were included in the study, while disabled/mentally retarded patients, patients using regular medication due to systemic disease, and patients receiving psychiatric treatment were excluded from the study.

The study has 2 main phases: anamnesis and clinical examination. In the anamnesis phase, after obtaining informed consent from the patients who met the inclusion criteria, they were asked to fill out the form containing the Children's Fear Survey Schedule-Dental Subscale (CFSS-DS).[13] Total score of the CFSS-DS ranges from 15 to 75, where 15-31 points indicate a low level, 32-38 points indicate a moderate level, and 39 and above indicate a high level of dental fear.

In the clinical examination section, the examination of the patient with an intraoral mirror and periodontal probe in the supine position of no more than 30° was completed. The degree of the gag reflex was noted by the dentist according to the gagging occurring at the intraoral trigger points in the Classification of Gagging Problem (CGP) index (Figure 1). According to the index, G1 indicates normal gagging but not desensitized, G2 indicates mild gagging, G3 indicates moderate gagging, G4 indicates severe gagging, and G5 indicates very severe gagging. In the study, G3 and above in the gag reflex index was accepted as having a gag reflex.

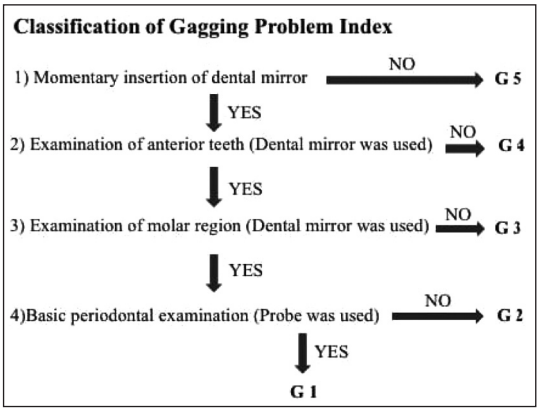

FIGURE 1: Classification of Gagging Problem Index.[7]

The study was performed in 417 participants presented to our pediatric dentistry clinic. Age, gender, dental fear score, and degree of gag reflex were recorded by the dentist.

STATISTICAL ANALYSIS

Data analysis was performed with the SPSS 20.0 (SPSS Inc., Chicago, IL, USA) program. For numerical variables, the Mann-Whitney U test was used for pairwise group comparisons, and the Kruskal-Wallis test was used for comparisons of more than 2 groups. The comparison of the qualitative variables was made with the chi-square test. The linear relationship between numerical variables was examined with Spearman's rho coefficient. Data were evaluated at 95% confidence interval.

RESULTS

Gag reflex was not detected in 294 (70.5%) of 417 patients during intraoral examination, and gag reflex was observed in 123 (29.5%) patients, varying in severity from 1 to 3 (Table 1). The patients' age ranged from 6 to 14 year, and the average age was 9.8 years. Gagging reflex was observed in 40.3% of the 6-8 age group, 29.5% of the 9-11 age group, and 16.1% of the 12-14 age group. There was a significant correlation between age group and reflex (p=0.000) (Table 2). However, a statistically significant difference was found between boys and girls in terms of gag reflex rates (p=0.002). The gag reflex was detected in 38.2% of the boys and 20.5% of the girls (Table 2).

When the relationship between dental fear and gag reflex level was examined, gag reflex was observed in 15.7% of the patients with low dental fear, 60.2% of the patients with moderate dental fear, and 72.5% of the patients with high dental fear. Table 2 also shows that as the severity of the gag reflex increased, the CFSS-DS values also increased.

According to the results of the one-way analysis of variance, in which the change of the dental fear score according to the reflex level was examined, a statistically significant difference was found between fear scores and gag reflex groups ($p<0.05$). According to the analysis, the fear level of those with a severe and very severe gag reflex was significantly higher than the fear level of those with a normal, mild, and moderate reflex. The fear level of those with a moderate gag reflex was significantly higher than those with a mild gag reflex, and the fear level of those with a mild gag reflex was significantly higher than those with a normal gag reflex (Table 3).

DISCUSSION

People with a high gag reflex may experience more difficulty with dental treatments.[14] It has been reported in the literature that patients avoid dental treatment.[15,16] Correct diagnosis and treatment may be difficult in children with a high gag reflex, since procedures such as radiological examinations and maxillary impression cannot be completed. In addition, difficulties in maxillary impression taking may prevent them from receiving orthodontic treatment or wearing removable (prosthetic) appliances.[8,12] In addition, dentists develop procedures to help ensure that treatment goes smoothly, as gagging will result in continued discontinuation of the pediatric age group who are less cooperative during dental treatment.

TABLE 1: Distribution of gag reflex severity.

Gag reflex severity	n	%
G1 (normal gagging)	161	38.6
G2 (mild gagging)	133	31.9
G3 (moderate gagging)	110	26.4
G4 (severe gagging)	11	2.6
G5 (very severe gagging)	2	0.5
Total	417	100

TABLE 2: Descriptive statistics of gag reflex values according to age, gender, and severity of dental anxiety.

			Gag reflex severity						
			G1	G2	G3	G4	G5	Total	p value
Age	6-8	n	43	40	49	5	2	139	=0.000*
		%	30.9	28.8	35.3	3.6	1.4	100	
	9-11	n	53	64	45	4	0	166	
		%	31.9	38.6	27.1	2.4	0	100	
	12-14	n	65	29	16	2	0	112	
		%	58	25.9	14.3	1.8	0	100	
Gender	Male	n	70	61	72	7	2	212	=0.002*
		%	33	28.8	34	3.3	0.9	100	
	Female	n	91	72	38	4	0	205	
		%	44.4	35.1	18.5	2	0	100	
Dental fear	Low	n	149	103	46	1	0	299	=0.000*
		%	49.8	34.4	15.4	0.3	0	100	
	Moderate	n	10	21	43	4	0	78	
		%	12.8	26.9	55.1	5.1	0	100	
	High	n	2	9	21	6	2	40	
		%	5	22.5	52.5	15	5	100	
Total		n	161	133	110	11	2	417	
		%	38.6	31.9	26.4	2.6	0.5	100	

*p<0.05

TABLE 3: Descriptive statistics of dental fear scores by gag reflex severity.

Gag reflex severity	n	Median	SD	F	p value
G1 (normal gagging)	161	22	5.7		
G2 (mild gagging)	133	26.4	7		
G3 (moderate gagging)	110	33.3	7.4		
G4 (severe gagging)	11	42.3	10.3	65.588	0.000*
G5 (very severe gagging)	2	48.5	4.9		
Total	417	27.1	8.6		

*p<0.05 F: One-way analysis of variance; SD: Standard deviation.

For example, patients identified to be risky in terms of gag reflex may be encouraged to breathe through the nose and move their feet up and down during dental impressions.[17] Therefore, being able to determine in advance which children are at higher risk for gagging will provide insight into the measures to be taken by the dentist.

There are various methods used to detect gagging findings. Van Linden van den Heuvell et al. presented the Gagging Problem Assessment (GPA) describing the patient's experiences associated with gagging.[18] The questionnaire evaluates the patient and the dentist separately, and Akarslan and Erten developed the Turkish version of the 9-item shortened patient version (GPA-pa SF) and reported it as a reliable and valid tool in Turkish.[19] In the study conducted by Katsouda et al. in 2021, a strong relationship was found between gagging and intraoral radiographic examination and/or intraoral photographing using the dentist version (GPA-de-c/SF).[10] They reported that it is a reliable tool in detecting gag reflex. In addition, it did not find a significant relationship between gag-

ging during tooth brushing and dental procedures. Therefore, they recommended that dentists not rely on this information when estimating the likelihood of gagging during dental procedures, but instead consider routinely applying "GPA-de-c/SF" in all children. However, since this study has not yet been published while we were conducting data collection of our study, we used the CGP index in our study. Moreover, in the anamnesis section, we used the CFSS-DS. The CFSS-DS is a scale that has been translated into many languages and is reported to have high validity and consistency.[20,21] This scale, whose reliability and validity has been validated in Turkish children, has been used in many studies in Türkiye and successful results have been reported.[22-24]

Although the gag reflex can occur in all age groups, prevalence studies are limited to the adult population. It was reported in an adult study that 8.2% of the patients developed gag reflex during dental treatment, compared to 49% in another study.[15,17] In 2016, Katsouda et al. linked differences in gagging prevalence to differences in sampling and/or differences in how gagging is assessed using self-report questionnaires and/or more objective methods.[25] While they found the prevalence of gagging in children as 6% in 2016, they found it as 28.47% in 2018.[10,25] The authors attributed the prevalence differences between studies to the evaluation of the first study in a school setting and the last study in a dental setting (i.e., where the child associates with dental treatment). According to their study in 2021, 21% of the children showed gagging during radiographic examination and 20% during intraoral photographic examination.[10] These findings emphasized how common gagging can be in the pediatric age group receiving routine dental treatment. Different age ranges included in the study and differences in study design may be effective factors in the variation of study results. Performing similar studies on large population groups with appropriate calibration of studies will increase the reliability of prevalence results.

In a study, it was found that gag reflex may be less common in older adults, while another study showed that patients with a gag reflex were older than those who did not.[26,27] According to the limited number of studies examining the gag reflex in children, the gag reflex has been found to be higher in the younger age group.[10,25] Elbay et al. investigated the effect of low level laser therapy on reducing the gag reflex in children, they found that gender was not related to the gag reflex, but there was a tendency for the gag reflex to improve along with age in the control group.[8] Our study results are also consistent with the literature.

The literature shows contradicting results regarding gender as a factor in the gag reflex. While some studies have reported that adult females are more prone to gagging than males, some others have found higher gagging in adult males than in females.[7,17,28] Some researchers have not observed gender differences in the gag reflex.[19,29] When the gender differences in the pediatric age group were evaluated, one study reported both higher anxiety and higher gagging in females.[25] In the study of Katsouda et al. in 2018, males were reported to experience more gagging than females in the pediatric age group, which is in line with our study findings.[30]

Patients who experience gagging during dental treatments may develop a tendency to gag during their future dental experience as a result of the gagging experience being accompanied by dental stimuli (dentist, dental instruments).[5,15] Therefore, as a result of gagging during dental treatment, the fear of the dentist and dental treatment may develop in the pediatric patient. In addition, gagging occurring during treatment may result in the dentist being unable to complete this treatment. This may result in a child with a high probability of gagging at the dentist through operant conditioning.[30] The literature findings on this subject associate more severe gagging with higher fear in adults.[15,19,29] However, there are only a few studies examining the relationship between dental fear and gagging in the pediatric population. While Katsouda et al. did not find a significant relationship between dental fear and gagging levels in their study in 2016, they reported a significant relationship in 2018 and 2021.[10,25,30] According to the study conducted in 2018, there was no significant difference between the pediatric age group evaluated in

a university pediatric dental clinic and those in a private pediatric practice in terms of gagging, indicating that the change of venue did not have an effect on gagging reflex.[30]

One of the limitations of the study was that it may be more appropriate to use more than one scale for the evaluation of dental fear. Using both subjective evaluation (self-report) and objective evaluation tools to assess the gag reflex would result in more grounded results. Due to the limited research on the subject in the pediatric population, more detailed studies on large population groups are required.

CONCLUSION

In accordance with the findings of this study, the prevalence of gag reflex is high in the pediatric age group. However, it is found that the gag reflex is more common in younger age groups. For pediatric dentists, the early detection of the gag reflex using short and applicable assessment tools before dental treatments may be beneficial for treatment control. According to the results of the study, considering that dental fear may also play a role among the factors affecting the gag reflex, controlling dental fear before dental treatment procedures in children will be beneficial in preventing the gag reflex.

Source of Finance

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Ayşe Hanım Karademir Göçeroğlu;* ***Design:*** *Ayşe Hanım Karademir Göçeroğlu, Ayşegül Ölmez;* ***Control/Supervision:*** *Ayşe Hanım Karademir Göçeroğlu, Ayşegül Ölmez;* ***Data Collection and/or Processing:*** *Ayşe Hanım Karademir Göçeroğlu;* ***Analysis and/or Interpretation:*** *Ayşe Hanım Karademir Göçeroğlu;* ***Literature Review:*** *Ayşe Hanım Karademir Göçeroğlu;* ***Writing the Article:*** *Ayşe Hanım Karademir Göçeroğlu;* ***Critical Review:*** *Ayşegül Ölmez.*

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