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## GAG REFLEX IN DENTISTRY: WHAT CAN WE DO?

### DİŞ HEKİMLİĞİNDE KUSMA REFLEKSİ: NE YAPABİLİRİZ?

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#### ABSTRACT

The gag reflex is a mechanism which prevents unwanted objects from entering the pharynx, larynx or trachea. Due to some reasons, the mechanism of this reflex could be damaged and impede on oral-health related behaviors and oral health of individuals. Besides, dentists face problems during dental diagnostic procedures and dental treatment of these patients according to the severity of the problem. It would be helpful for a dentist to be able to identify problematic gagging of a patient before starting dental diagnostic and treatment procedures. Problematic gag reflex could be assessed with special designed questionnaires before starting a dental procedure of the patient. Behavioral approaches, complementary medicine therapies and pharmacological techniques are methods used for the treatment of patients with problematic gagging. The aim of this article is to describe problematic gagging and give information about the special designed scales, and the techniques which could be applied for the elimination of the problem.

**Keywords:** Gagging, dentistry, questionnaires, dental treatment

#### ÖZ

Kusma refleksi istenmeyen cisimlerin farinks, larinks ve trakeadan girişini engelleyen bir mekanizmadır. Birtakım etkenler bu mekanizmanın normal çalışmasını bozarak bireylerin oral hijyeni alışkanlıklarını ve oral sağlığını etkileyebilmektedir. Bununla birlikte, diş hekimleri de dental diagnostik prosedürlerde ve dental tedavi sırasında durumun şiddetine göre birtakım problemler yaşayabilmektedir. Bu işlemlerin öncesinde diş hekiminin hastada sorun yaratacak bir kusma refleksinin olup olmadığını belirlemesi hekime yardımcı olacaktır. Hekimler hastalarında problem oluşturacak kusma refleksi olup olmadığı tedaviye başlamadan önce özel skalalar yardımı ile değerlendirebilmektedir. Problem yaratacak düzeyde kusma refleksi bulunan hastaların tedavilerinde davranışsal yaklaşımlar, tamamlayıcı medikal terapiler ve farmakolojik teknikler kullanılmaktadır. Bu makalenin amacı dental işlemler sırasında problem oluşturan kusma refleksini tanımlamak, refleksin belirlenmesi için kullanılabilecek skalaları ve problemin eliminasyonu için uygulanabilecek yöntemler hakkında bilgi vermektedir.

**Anahtar Kelimeler:** Kusma, diş hekimliği, anket, dental tedavi

#### INTRODUCTION

The gag reflex is a normal mechanism which prevents unwanted material from entering the pharynx, larynx or trachea.<sup>1</sup> It occurs from an "involuntary contraction of the muscles of the soft palate or pharynx which results in retching"<sup>2</sup> and is primarily controlled by the parasympathetic division of autonomic nervous system.<sup>3</sup>

Normally, the palatoglossal and palatopharyngeal folds, base of tongue, palate, uvula, and posterior pharyngeal wall are trigger points of gag reflex.<sup>4</sup> However, anatomic abnormalities of soft palate, uvula, fauces, posterior pharyngeal wall and the tongue, pathologies of the nasal cavity and sinuses, stress, phobia, alcoholism, visual and olfactory stimuli,<sup>5</sup> excess saliva accumulation<sup>6</sup> inadequate posterior

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palatal seal of the prosthesis and restricted tongue space due to prosthesis<sup>5</sup> can exaggerate the gag reflex.

The exact prevalence of exaggerated gag reflex is unknown.<sup>7</sup> In a study, patients' self report of gagging during dental procedure was found to be as 8.2%.<sup>8</sup> The percentage of problematic gagging during intra-oral dental radiographic procedures was reported to be as 10–25% in another investigation.<sup>9</sup> The frequency of problematic gagging during dental procedure was assessed and it was found that 49.2% of the patients were reported to gag rarely, 43.3% to gag moderately and 7.5% to gag at a high frequency in dental clinics.<sup>10</sup>

Exaggerated gag reflex has impact on routine oral-health behaviors and oral health status of individuals. Some individuals have difficulty during tooth brushing, especially in the posterior region of the oral cavity, thus are prone to have more dental cavities, a higher frequency of gingival bleeding during tooth brushing and wearing a higher number of complete dentures compared to the patients without a severe gag reflex.<sup>8</sup>

Patient cooperation and compliance are essential for diagnostic procedures and successful dental treatment.<sup>11-15</sup> Problematic gagging can complicate the tasks of dental procedure. Depending on the severity of gagging, some patients cannot tolerate the placement of the dental mirror, dental films and impression trays in their mouth, which are the basic steps required for diagnosis and treatment.<sup>14</sup>

It would be helpful for a dentist to be able to identify and characterize problematic gagging before starting dental diagnostic and treatment procedures. Such identification would alert the clinician to the situation and allow him/her to formulate strategies for dealing with the problem.<sup>9,14,16,17</sup>

### Questionnaires Used to Identify Problematic Gagging

Gag reflex could be assessed with a single item self report measure question and special designed questionnaires.

A single item question 'Do you tend to gag during dental treatment?' with answer options 'yes' or 'no' assesses the gagging problem grossly. Detailed information could be gathered with special designed questionnaires including multiple items.<sup>8</sup>

The 'Gagging Assessment Scale' (GAS) is a short questionnaire consisting 4 items having 5 multiple choice answers related with the feeling of nausea or vomiting during specific dental procedures. In this questionnaire each answer is given a numeric score ranging from 1 to 5. The total score is obtained by summing up all scores given to the four questions. The total GAS score ranges from 4 to 20, with the higher score indicating a greater tendency to gag. (Table 1)<sup>18</sup>

Table 1. The questions of the Gagging Assessment Scale<sup>18</sup>

<b>1- How do you feel when you brush your back teeth?</b> a.I experience no nausea whatsoever b.I feel slightly nauseated c. I am afraid I will vomit d. I can't do it because I immediately feel nauseated and fell like vomiting e. I experience actual spasms in my throat and sometimes actually vomit
<b>2-How do you feel when you are waiting in the dentist's waiting room and thinking about the anticipated dental treatment?</b> a.I experience no nausea whatsoever b.I feel slightly nauseated c. I am afraid I will vomit d. I can't do it because I immediately feel nauseated and fell like vomiting e. I experience actual spasms in my throat and sometimes actually vomit
<b>3-How do you feel when you are sitting in the dental chair and the dentist is checking your teeth with a mirror and other instruments?</b> a.I experience no nausea whatsoever b.I feel slightly nauseated c. I am afraid I will vomit d. I can't do it because I immediately feel nauseated and fell like vomiting e. I experience actual spasms in my throat and sometimes actually vomit
<b>4-How do you feel when the dentist is working on your back teeth?</b> a.I experience no nausea whatsoever b.I feel slightly nauseated c. I am afraid I will vomit d. I can't do it because I immediately feel nauseated and fell like vomiting e. I experience actual spasms in my throat and sometimes actually vomit
<b>The score for each answer is:</b> 1=I experience no nausea whatsoever 2=I feel slightly nauseated 3= I am afraid I will vomit 4= I can't do it because I immediately feel nauseated and fell like vomiting 5= I experience actual spasms in my throat and sometimes actually vomit
The total GAS score ranges from 4 to 20, with the higher score indicating a greater tendency to gag.

The 'Predictive Gagging Survey' is a survey consisting of 10 questions. It is reported to be a reliable and valid instrument for predicting problematic gagging and the intensity of the gag reflex of a patient in dental procedure. In this survey each answer is given a numeric score and the overall sum indicates the severity of gagging. A total score over 7 indicates moderate gagging in response to an impression procedure. (Table 2)<sup>19</sup>

The 'Gagging Problem Assessment Questionnaire' (GPA) is a Likert type questionnaire. It is consisted of a patient section and a dentist section. The patient-completed section determines self perceptions related to any gag reflex that might occur during procedures related to dental hygiene, examination or impression procedure. The dentist part of the questionnaire serves as a confirmation of the results obtained from the patient section by the dentist assessing the gag reflex by touching various sites in the oral cavity with a dental mirror.<sup>11,12</sup> The original long Dutch version<sup>11</sup> and shorter Turkish versions of the questionnaire<sup>12</sup> were found to be reliable and valid instruments. After the intervention of this questionnaire, three cut off points for the prediction of problematic gagging and its severity was introduced in another study.<sup>14</sup> In 2015, the GPA was re-evaluated and two questions related with occurrence of gagging due to tactical stimulation of the tongue were added to the dentist part of the questionnaire. (Table 3)<sup>11,12,20</sup>

### Management of Problematic Gagging

The 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.<sup>5</sup>

Behavioral approaches, complementary medicine therapies and pharmacological techniques are used for the treatment of problematic gagging in dentistry.

Table 2. The questions of the Predictive Gagging Survey<sup>19</sup>

For the following questions, please use the scale of 1-7, in which 1 is the least severe and 7 is the most.

**1. Do you have a gag reflex? YES/NO**

**2. How strong would you say your gag reflex is? Please circle the corresponding number on the following scale.**

1 2 3 4 5 6 7

Not strong at all-----moderately strong-----very strong

**3. Have you ever had a negative incident with gagging? YES/NO**

**4. Have you ever gagged at a dentist/orthodontist office before? YES/NO**

**5. Please circle any of the following experiences that have caused you to gag:**

Routing teeth-cleaning  
Root canal Cavity filling  
Dental impression  
Dental x-ray  
Other orthodontic work  
Other dental work

**6. When you are going to the dentist, how much stress (if any) do you experience that is related to your gag reflex? Please circle the corresponding number on the following scale.**

1 2 3 4 5 6 7

none -----somewhat-----much-----a great deal

**7. Have daily activities, like brushing or flossing your teeth, ever made you gag? YES/NO**

**How often are these occurrences?**

1 2 3 4 5 6 7

never -----seldom-----sometimes-----often

**8. Do you ever worry that daily activities other than brushing or flossing your teeth will cause you to gag? YES/NO**

**9. Does coughing ever cause you to gag? YES/NO**

**10. Have you ever gagged while trying to swallow pills? YES/NO**

**Survey Scoring**

1. yes = 1, no = 0  
2. 1-2 = 0, 3-5 = 1, 6-7 = 2  
3. yes = 1, no = 0  
4. yes = 1, no = 0  
5. 1 point for each item circled  
6. 1-2 = 0, 3-5 = 1, 6-7 = 2  
7. yes = 1, no = 0 / 1-2 = 0, 3-5 = 1, 6-7 = 2  
8. yes = 1, no = 0  
9. yes = 1, no = 0  
10. yes = 1, no = 0

Score over 7 indicates moderate gag reflex in response to an impression procedure. Patients may benefit from treatment methods to control gagging.



Table 3: The questions of the Gagging Problem Assessment Questionnaire-Short Form<sup>11,12,14,20</sup>

<p>Patient part</p> <p>Instruction: Please estimate your degree of gagging in the following situations. Cases in which you avoid a situation because of your gagging problem, please encircle 'always'. Cases which are not applicable encircle 'NA'</p> <p><b>Brushing your teeth</b> No Sometimes Often Always NA</p> <p><b>Wearing a removable prosthesis</b> No Sometimes Often Always NA</p> <p><b>Laying backwards in dental chair</b> No Sometimes Often Always NA</p> <p><b>Feeling the mirror in front of your mouth</b> No Sometimes Often Always NA</p> <p><b>Feeling the mirror in your mouth near anterior teeth</b> No Sometimes Often Always NA</p> <p><b>Feeling the mirror in your mouth</b> No Sometimes Often Always NA</p> <p><b>Feeling the mirror between posterior teeth</b> No Sometimes Often Always NA</p> <p><b>Taking an impression of the lower jaw</b> No Sometimes Often Always NA</p> <p><b>Taking an impression of the upper jaw</b> No Sometimes Often Always NA</p> <p>Dentist part</p> <p>Instruction: Please indicate the presence of gagging in the following situations when the back of the dental chair is not more than 30° in supine position. Encircle 'yes' for cases in which you have been unable to perform an action because of gagging reflex</p> <p><b>Holding the mirror</b> <b>Outside the mouth, in front of opened mouth</b> No Yes</p> <p><b>In the mouth, at the level of second molars</b> No Yes</p> <p><b>In the mouth, touching behind the upper incisors</b> No Yes</p> <p><b>In the mouth, touching transition to soft palate</b> No Yes</p> <p><b>On the inner side of the cheek, at the level of second molars</b> No Yes</p> <p><b>Touching the maxillary process, at the level of molar 7 / 8</b> No Yes</p> <p>Scores given to the answers: No: 1 Sometimes: 2 Often: 3 Always: 4</p> <p>Total score: The sum of scores given for each question/The total number of questions answered. (The number of questions answered as 'not applicable' is excluded from the total number of answered questions; therefore this does not have an adverse effect on the score)<sup>14</sup></p> <p>The cut-off points of the questionnaire 1.00-1.74: score 0 indicating no gag reflex or only mild discomfort 1.75-3.24: score 1 indicating moderate gag reflex 3.25-4.00: score 2 indicating severe gag reflex</p> <p>Following items were added to the dentist part of the scale (van linden van den heuvel et al. in 2015)<sup>20</sup></p> <p><b>On the back of the tongue, at the level of molar 7/8</b> No Yes</p> <p><b>Side of the tongue, at the level of the second molars</b> No Yes</p>
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## Behavioral Approaches

### *Relaxation, Distraction and Systemic Desensitization*

Relaxation is a basic step for the management of the problem. The dentist can make an interview with the patient about his/her dental fears and advise relaxation therapy several times a week. Audiotapes including imagery, progressive muscle relaxation and self-suggestion components could be useful to reduce the patient's arousal level sufficiently to decrease or eliminate gagging.<sup>21</sup>

Distracting the patient's attention from the stimulus will suppress the awareness and thought of 'this is going to make me gag'. This can be achieved by activities performed by the patients such as, raising legs and swallowing, breathing deeply and audibly, holding breath<sup>14</sup> and tapping rhythmically a foot on the floor while breathing steadily and audibly.<sup>22</sup>

Systemic desensitization is based on the hypothesis 'incompatible thoughts and expectations of the patients can be changed by positive experience'.<sup>5,23,24</sup> In this method the patient is familiarized with the gag provoking stimulus gradually. This allows the patient to tolerate the stimulus in his or her mouth in bigger sizes and longer time compared to the beginning of the treatment. A toothbrush, intraoral film, impression tray, marbles, acrylic discs, buttons, dentures and training devices are reported to be useful substances for systemic desensitization.<sup>5,24-26</sup> In edentulous patients a training plate (acrylic denture bases without teeth) are useful in patients whom impression of the jaw could be made.<sup>27</sup> Saita et al.<sup>28</sup> reported that with 1 year of behavioral adjustment, systemic desensitization was successful among gaggers whom dental procedures could be performed without the need of sedation but this technique was almost unsuccessful among gaggers whom treatment was performed under sedation.

## Complementary Medicine Therapies

### *Acupuncture*

Acupuncture is defined as "the insertion of a solid needle into specific parts of the human body".<sup>29</sup> Acupuncture is applied in acupuncture caves which are sensitive points in the human body that feel soreness and distention.<sup>30</sup>



Acupuncture points could be stimulated by needles, pressure, vacuum, laser or electrical stimulus.<sup>31</sup> Needle acupuncture and laser acupuncture were reported to be useful for the elimination of hyper-sensitive gag reflex. The anti-gagging point of the ear,<sup>32</sup> Pericardium 6 (PC 6; located on the forearm approximately 1 inch above the wrist crease) and Conception Vessel 24 (CV 24; located in the labio-mental fold on the chin) were reported to be useful acupuncture points for the suppression of problematic gagging.<sup>33</sup> On the other hand, one study failed to find any benefit of acupuncture to point PC6 in terms of reduction of gagging.<sup>34</sup>

Laser acupuncture is the stimulation of traditional acupuncture points with low-intensity, non-thermal laser irradiation.<sup>35</sup> Low level laser stimulation (photobiomodulation) of acupuncture points is a new technique that has been reported to be successful to control extreme gag reflex. This is non-invasive as needles are not used to stimulate acupuncture points. Besides, no heat or vibration occurs during application of the laser beam. The application time is short and the equipment is cost effective.<sup>36</sup>

The depth of laser transmission through skin varies from by approximately 0-1mm for wavelengths of 400nm to up to 5nm for wavelengths of 1200nm. Red and infrared laser lights are most often used for laser acupuncture. These lights have wavelengths of 700nm and above. Compared with other laser lights, their absorption level is lower and their transmission level is higher. The efficacy of laser acupuncture is primarily based on the depth of laser energy transmission through the skin which is affected by skin thickness, age and pigmentation.<sup>35</sup>

Sarı and Sarı<sup>29</sup> found that low level laser application to CV 24 was an effective method for the suppression of the gag reflex among orthodontic patients during maxillary impression procedure. Elbay et al.<sup>33</sup> reported stimulation of PC 6 with low level laser was effective to control gag reflex during intra-oral radiographic examination of pediatric patients.

Although needle acupuncture and laser acupuncture could be used for the elimination of problematic gag reflex in dentistry, these techniques must be applied by a trained clinician on acupuncture.

#### *Acupressure*

Acupressure is the stimulation of the traditional acupuncture points with pressure. Different from needle acupuncture it is non-invasive as no needles penetrate the skin. It does not require any special equipment and there are no side effects.<sup>37</sup> The pressure applied in this technique is progressively increased until the patient feels discomfort and distension. Acupressure should start at least 5 minutes before the dental procedure and be terminated only after the procedure is completed.<sup>38</sup>

A clinical report has indicated that light pressure with the index finger to Chengjiang (REN-24; located at the horizontal mentolabial groove, approximately midway between the chin and the lower lip) would be effective to control gagging during impression making.<sup>38</sup> In another report, stimulation of Neiguan (concave area at medial aspect by the forearm) and Hegu, (concave area between the first and the second metacarpal bones) with the thumb for 5 to 20 minutes was reported to be a useful technique also.<sup>30</sup>

#### *Hypnosis*

Hypnosis is defined as 'an attentive, receptive, focal concentration, with diminished peripheral awareness'. Expectancies, motivation, absorptive capacity/fantasy proneness, and attitudes towards hypnosis are important factors for the outcome of the therapy.<sup>39</sup> Hypnosis provides sedation whilst maintaining patient collaboration. It helps patients recovering from dental anxiety, dental phobia and extreme gag reflex. This technique should be applied by a special trained clinician.<sup>40</sup> It was reported that the application of hypnosis in the form of hypnosedation was found to be successful during dental treatment. Hypnosis can be combined with acupuncture (hypnopuncture), and could be used for long-term therapy for patients with problematic gagging.<sup>41</sup>

#### *Pharmacological Techniques*

##### *Topical anesthesia and local anesthetic injection*

Topical anesthesia of the oral mucosa is a practical method which could be used for the management of problematic gagging in dental clinics. Topical anesthesia could be applied by anesthetic agents in the form of spray, gel, lozenge and mouth rinse. It was also reported that the use of topical benzocaine 14%, butyl aminobenzoate 2% or tetracaine



hydrochloride 2% to the palate by gauze pad was an effective method.<sup>42</sup> Some patients may benefit from the application of topical anesthesia, while it could increase nausea and gagging in others.<sup>43,44</sup>

Injecting local anesthetic into the posterior palatine foremen is another choice for anesthesia of the palate.<sup>45</sup> This is useful in patients having moderate gagging but could be not applied in severe gagging cases as the patient could not tolerate the insertion of the injection needle.<sup>46</sup>

#### *Drugs, Sedation and General Anesthesia*

The use of drugs, sedation and general anesthesia is the last step for the management of problematic gagging. These methods are applied to the patients who have severe gag reflex and do not respond to other methods.

Antihistamines, sedatives and tranquilizers, parasympatholytics, and central nervous system depressants,<sup>47</sup> antiemetic drugs<sup>48</sup> are used for problematic gagging. Drugs are good in term but offer only a short-term solution and have certain adverse side effects.<sup>47</sup>

Sedation is another choice for patients who are intolerable to dental treatment in association with behavior therapy or topical anesthetic application.<sup>49</sup> Sedation could be applied by inhalational, oral or intravenous agents.<sup>50</sup> These agents may temporarily eliminate the gag reflex during dental treatment while maintaining reflexes protecting the patients' airway.<sup>5,51</sup>

Nitrous oxide is the most commonly used inhalation anesthetic in dental procedures.<sup>52</sup>

It alters the perception of external stimuli and increases the patient's tolerance of dental equipments placed in the oral cavity and reduces the anxiety and fear associated with gagging.<sup>53</sup> The benefit of oral sedatives may be different among patients in terms of the management of gagging. Generally it is useful in mild gaggers with an underlying anxiety state.

Intravenous sedation is applied in the case where inhalation sedation is ineffective. The benefit of intravenous sedation is more than oral sedatives.<sup>5</sup> Disadvantages of intravenous sedation are the long recovery time after application and the occasional need for admission to hospital.<sup>49</sup>

Dental treatment of patients who have an extreme gag reflex which could not be handled with the techniques above can be done under general anesthesia, but this method has risks associated with

general anesthetic agents and technique and limited resources are available for the provision of restorative treatment.<sup>5</sup>

## **CONCLUSION**

Dentists encounter patients experiencing gagging problems during dental treatment. The knowledge of the etiology of problematic gagging and its management during dental procedure is essential for a successful treatment.

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