



# **TRABAJO DE FIN DE GRADO**

*Grado en Odontología*

## **PERIODONTAL DISEASE AND HARMFUL HABITS**

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## **ABSTRACT**

### **Introduction:**

Periodontitis is the most common oral disease, affecting up to 90% of the global population. There are many habits that can cause periodontitis in different magnitudes of severity. In this study, we assess the self-perception of periodontal changes based on smoking, alcohol consumption, and improper oral hygiene practices. We learn that a thorough anamnesis is the first essential step in detecting susceptibility and is exacerbated by harmful habits that can modify the host's defence system.

### **Objectives:**

The main objective of this study was to assess the self-perceived periodontal changes in the oral cavity based on different harmful habits. This has been achieved by using books and articles that helped gain a better understanding about the significance of the different risk factors and the role each of them plays in the progression of periodontitis. Finally, we discuss different approaches on how to reduce the risk of developing periodontitis, considering the patients' habits.

### **Methodology:**

An online questionnaire comprised of 10 questions, of which 4 were related to self-perceived periodontal changes in the oral cavity and 6 to different harmful habits and oral hygiene measures. These were then plotted in graphs and frequency tables to answer the objectives.

### **Results:**

Smokers, daily drinkers, and those who brushed their teeth once a day reported the highest percentage of noticing longer teeth, increased tooth mobility and halitosis. Participants who brushed their teeth once a day experienced more cases of gingivitis, tooth mobility, and halitosis.

### **Conclusions:**

There seems to be a potential pattern between the self-perception of periodontal changes in the oral cavity based on the smoking, alcohol, and tooth brushing frequency. However, there are exceptions among the findings, which suggest that further investigations using statistically significant data would objectively reach further conclusions.

**Keywords:** dentistry, periodontitis, self-perception, harmful, habits

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## **INTRODUCTION**

Being prevalent in up to 90% of the global population, periodontitis is ranked as the most common oral disease in the world (1,2). It is a complex disease with dynamic interactions between various components in our mouths (3). These can lead to a series of pathological processes that can affect us severely and that can prompt further complications. However, before getting to this stage, we firstly pass through the phase of gingivitis, which can be defined as “the presence of gingival inflammation, whereby the gum can appear reddened, swollen, and may easily bleed, but without loss of connective tissue attachment” (4). Gingivitis can occur due to many reasons, which are determinant for developing periodontitis subsequently. Common reasons include infrequent or improper (e.g., aggressive) brushing techniques, a diet high in simple carbohydrates, a weakened immune system, and high plaque accumulation which can be attributed to seldom visits to the dentist. Only by ignoring and not acting upon gingivitis and its causing factors can we be subject to periodontitis (5).

High plaque accumulation can be found either supragingivally (above the gingival margin) or subgingivally (below the gingival margin). Supragingival plaque can result in dental caries if it's not professionally removed, and if left untreated, the caries can produce reversible or irreversible pulpitis (i.e., inflammation of the pulp) that can produce pain, cause sensitivity, and cause a periapical abscess, for which in many cases a root canal treatment will be needed. Subgingival plaque can also cause caries but also produces gingivitis, periodontitis, and periodontal abscesses, that can disseminate into adjacent bones and soft tissues of the head and neck, potentially posing a life-threatening situation to the patient (6).

Periodontitis can be characterized by either horizontal or vertical bone loss, which have some common but also different underlying causes. Horizontal bone loss is found more frequently than vertical defects and occurs when the alveolar bone is gradually resorbed in a horizontal direction (7). This can be caused by a variety of factors, including smoking, bacterial infections, mechanical trauma, and excessive occlusal forces. Poor oral hygiene can also contribute to the development of horizontal bone loss, as bacteria in plaque and

tartar can cause inflammation and damage to the supporting structures of the teeth. This phenomenon will be further explained below in the section of pathogenesis. Vertical bone loss, on the other hand, occurs when the alveolar bone is destroyed in a vertical direction. It is caused by many of the same factors as horizontal bone loss, including bacterial infections, trauma, and occlusal forces. This type of bone loss is usually more severe as it has shown to have worse treatment success, but they can both ultimately lead to tooth mobility and eventual tooth loss through the destruction of the periodontal ligament (PDL) and subsequent detachment from the bone (8).

As the bone is gradually resorbed, the gingiva recedes along with it, thereby exposing the underlying enamel or in more serious cases also the root of the tooth, giving it an overall longer appearance (*Figure 1*). This phenomenon is known as “gum recession”(9).



**Figure 1** Clinical aspect of gum recession (9).

## ANAMNESIS

A thorough anamnesis is vital for controlling the evolution of periodontitis in patients. There are certain unmodifiable factors and medical conditions which have shown to increase the risk and exacerbate the progression of periodontitis such as gender, genetics, age, and certain medical conditions such as diabetes, or other systemic diseases. An unhealthy lifestyle involving either a poor diet, smoking, consuming alcohol, or all of them together, have also shown to induce, intensify, and worsen the prognosis of periodontal disease. (4,10–12).

Signs and symptoms of periodontitis can include: Swollen or puffy gums, bright, red, dusky, red or purplish gums, gums that feel tender when touched, bleeding gums, pink-tinged toothbrush after brushing, spitting out blood when brushing or flossing your teeth, bad breath (halitosis), pus between your teeth and gums, loose teeth or loss of teeth, painful chewing, new spaces developing between your teeth (black triangles), gums that pull away from your teeth making your teeth look longer than normal (gum recession), and changes in the way your teeth fit together when you bite (occlusal defects).

## TYPES

There are a few different types of periodontitis. The most common type is the standard form, which is the chronic periodontitis. More types include the necrotizing periodontal disease and the aggressive periodontitis (which can be localized or generalized).

## PATHOGENESIS

The pathogenesis of periodontitis involves several stages and processes that happen in the mouth. According to the "Page and Schröder Model", there are 4 different stages that occur all within only the first month. The first is the "initial gingival lesion" that takes place within the first 24 hours, and it is characterized by vasculitis, leukocyte migration (mainly neutrophils), vascular extravasation, sulcular exudation, and alteration of the junctional epithelium (JE). As bacteria produce endotoxins, cytokines are induced by host cells, thus triggering inflammatory alterations that increase vascular permeability and engorgement of blood vessels, allowing the neutrophils to reach the site (13). After 7 days of plaque accumulation, it progresses to the "early lesion" which involves an exacerbation of the alterations of the previous stage. Additionally, we can observe accumulation of lymphocytes underneath the JE, and loss of collagen, thereby leaving space for more leukocyte infiltration. Basal cell proliferation in the JE and the sulcular epithelium (SE) may also be appreciated during this stage. These changes provoke more severe inflammation. 3-4 weeks later it becomes an "established lesion" in which there is already 10-30% of plasma cell prevalence. Extravascular immunoglobulins can be detected and there is

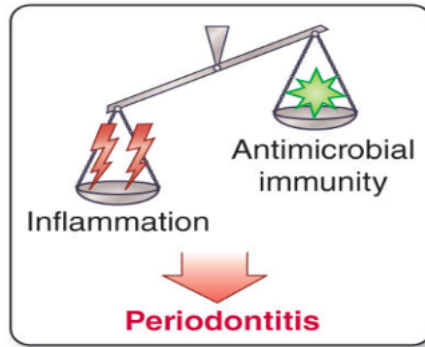
persisting loss of collagen, as well as proliferation and migration, and lateral extension of the JE. If left untreated, we reach the last stage, which is the advanced lesion (i.e., periodontitis). It is the point at which periodontal pockets become deeper due to apical migration of the JE. In this stage there is more than 50% of plasma cell predominance and most importantly destruction of bone and PDL, which directly correlates with tooth mobility (5,14).

## PATHOGENS / HOST RESPONSE

It is understood that facultative and strictly anaerobic bacteria play a role in the development of periodontal disease, however it is also important to note that the host response is also a key factor that plays a decisive role in its progression, as deficient antimicrobial immunity has shown to also contribute to periodontitis, as can be seen in *Figure 2*. (2,11,14).

Facultative bacteria such as *Aggregatibacter actinomycetemcomitans* and different bacteria from the Streptococcus and Actinomyces families are amongst the first bacteria to colonize the gingival crevice, thus giving support and living conditions to the deeper, strictly anaerobic bacteria, which include bacteria such as *Porphyromonas gingivalis*, *Tannerella forsythia*, *Treponema denticola*, *Prevotella intermedia*, and *Fusobacterium nucleatum*. These are found deeper in the gingival crevice and are therefore also more virulent in nature. They have slightly different roles but are ultimately responsible for creating cell death and inducing bone resorption. *Porphyromonas gingivalis* is among the fiercest bacteria as it has the capacity of compromising our innate host defences by converting the symbiotic community in our oral cavities into dysbiotic ones, as well as being capable of causing inflammatory reactions in phagocytic cells (10,12,14,15).

Cells responsible for combating these pathogenic bacteria are produced by our immune system and include *neutrophils*, *eosinophils*, *basophils*, *mastocytes*, *macrophages*, *B* and *T lymphocytes*, which are recruited via *cytokines* to induce a certain type of host response (14–16).



**Fig.2** Imbalance in host immunity in the development of periodontitis (14).

## TREATMENT AND PREVENTION

Prevention of periodontitis mainly involves removing and preventing the formation of biofilm, however raising awareness about the pathophysiology of the disease and its leading causes is also crucial (11). Avoiding exposure to risk factors and being informed about the correct oral hygiene techniques are essential for maintaining a healthy environment in the oral cavity. Routine check-ups are also crucial for achieving an early diagnosis and to control the progression of the disease. Moreover, as described earlier, a detailed anamnesis must be performed by the professional to understand the background of the patient and to be able to detect any susceptibility the patient might have towards the disease.

Furthermore, the possibility of vaccination against periodontitis has been discussed but has so far not found much success. The reason being for this is that the collateral tissue damage caused by leukocytes from the host's response plays a more important role than the bacterial action itself. Since we are essentially producing and directing cells to the periodontal spaces, thereby creating inflammation and destruction of our own tissues, we would need a vaccine that would also target our own immune cells, which certainly is not a feasible option (5).

If prevention fails and periodontitis is present in a patient, a complete periodontal study should be carried out. It is an in-depth analysis that typically consists of a series of sixteen periapical x-rays, as well as measuring pocket depths (six sites per tooth), gum recession (distance from gingival margin to



cemento-enamel-junction), bleeding on probing (all three with the use of a CP12 periodontal probe), furcation grades (using a Naber's probe), and testing tooth mobility (simultaneously using the backside of two dental mirrors from palatal/lingual and vestibular), which will all be recorded in the periodontogram of the patient. After having performed these clinical and radiological tests, the clinician will be able to classify the patient into a specific category of an internationally used staging-and-grading system ("2017 Classification of Periodontal and Peri-implant Diseases and Conditions") described by the American Academy of Periodontology (AAP) and the European Federation of Periodontology (EFP). Categorizing the patient will help the dentist to identify the risk level, enabling him/her to come up with a suitable treatment plan and assess the urgency with which it should be carried out. Each step should always be communicated to the patient, as it is an important component of any treatment for them to be able to make informed decisions about their oral health and be aware about the gravity, or not, of their periodontal situation.

Once it has been established that the patient is suffering from periodontitis, it is essential to swiftly arrange new appointments with him/her to carry out professional cleaning. Depending on whether it is a localized or generalized problem, we must perform either a full mouth, or selective SRP (Scaling and Root Planning) of the affected teeth. In the case of a full mouth SRP, the appointment should be divided over two sessions (quadrants 1/4 and 2/3). This is done to avoid numbing the full mouth at once, which can oftentimes be unpleasant for the patient at the end of the appointment.

Prior to starting the treatment, the patient should be anesthetized, always considering his/her medical history. Following this, the clinician will perform tartrectomy of the teeth, introducing the tip of the ultrasound up to 3mm into the pockets, which is considered the limit of non-pathological probing depths. Next, the professional will look at the periodontogram from the previous appointment to localize the deeper (>3mm), active (bleeding) pockets and finally carry out SRP on these specific sites by entering with sharpened Gracey curettes. By essentially using these instruments to scrape the teeth, any subgingival calculus that might have accumulated is removed and a smooth surface is achieved along the tooth, making it much harder for bacteria to adhere and prompt any further complications. At the end of the treatment, it is important to

reinforce the oral hygiene techniques with the patient and prescribe them 0,2% Chlorhexidine mouth rinses, which should be used twice daily during 30 seconds for the following 7 days after treatment (17). Following the first month, re-evaluation must be carried out, which involves updating the periodontogram to assess if there has been any improvement since the start of the treatment. After 3-6 months (depending on the motivation of the patient), the clinician must then carry out periodontal maintenance. This implies coming up with a new suitable treatment plan and performing SRP wherever is needed.

#### ANTIBIOTIC THERAPY

Before performing bloody dental procedures (such as tartrectomies, SRPs, extractions, etc.) on high-risk patients that are susceptible to infective endocarditis (e.g., due to a stent or valvular prosthesis) and in cases where there is proneness to bacteraemia, the dentist must prescribe a specific antibiotic regimen of prevention that the patient must strictly follow, as not doing so could be lethal. In a healthy population, the yearly incidence of infectious endocarditis is around 10 per 100,000, although it is rising. Despite breakthroughs in diagnosis and therapy, it still has significant related morbidity and mortality. The proportion of bacteraemia has additionally revealed to be substantially higher in patients presenting periodontitis than in those with either good oral health or gingivitis. To prevent these dangerous complications, 2g of amoxicillin are typically administered 1 hour before beginning the treatment and cefuroxime or clindamycin in cases where the patient is allergic to penicillins (10).

Antibiotics can also be indicated in other further situations related to periodontitis. For example, if a patient presents a periodontal abscess or needs a full mouth SRP, the dentist should prescribe metronidazole to increase treatment success. Prescribing metronidazole in adjunction to amoxicillin (500mg/500mg) during full mouth SRPs has shown to significantly improve the periodontal condition after a 3 and 6 months follow-up period (18).

Another interesting and innovative line of research that is currently being carried out involves the use of probiotic bacteria as a replacement or conjunction for synthetic antibiotics. The Food and Agricultural Organization /

World Health Organization describe probiotics as "live microorganisms that, when administered in sufficient amounts, confer a health benefit on the host" (11).

*Bdellovibrio bacteriovorus* is a predator-like probiotic bacteria found in rivers and lakes that can survive without prey and can form a biofilm. When prey comes, it fuses with the membrane of the bdellovibrio by going through the periplasmic space, forming a bdelloplast, which increases in size until it bursts and is released. It acts much like a virus but is more powerful because it can survive without a host. Additionally, it has found to be sensible to penicillin, thus also possessing low pathogenic potential for humans. When administered, it contributes to killing pathogenic bacteria (prey). The results of a successful study conducted at a university in Rome, showed that there was a 53% decrease in prevalence of *E. coli*, a 58% decrease in *Eikenella Corrodens* (which is also pathogenic in the periodontium), and a sizeable 75% decrease in one of the most pathogenic bacteria in the progression of periodontal disease, namely *Aggregatibacter actinomycetemcomitans*. *Fusobacterium nucleatum* displayed immunity to the administered probiotic (19).

## PERIODONTAL SURGERY

In more advanced cases, where we can find deeper pockets of at least 7mm, periodontal surgery is indicated. This usually involves surgically opening a flap to expose the roots of the affected teeth, allowing the periodontist to access the subgingival areas so deeper cleaning can be carried out. For this, SRP is performed conventionally using Gracey curettes.

## IMPLANT PROGNOSIS

Patients with history of periodontitis have proved to have lower success rates for implant prognosis than non-periodontal patients. Apart from previous presence of periodontitis, other factors such as smoking, bad oral hygiene, genetics, and diabetes have shown to be possible risk markers of distinct severity that could lead to the formation and evolution of biological complications around dental implants, such as peri-implantitis; previous history of periodontal disease being one of the main risk factors among them. Peri-implantitis is described as a "destructive inflammatory lesion of polymicrobial

aetiology (Charalampakis et al. 2011), which affects both soft and hard tissues around osseointegrated implants, leading to bone loss and the formation of a peri-implant pocket.” (Zitzmann & Berglundh 2008). The frequency of biological issues with dental implants also appears to be influenced by the degree of periodontitis. When compared to patients with a mild condition or those who are periodontally healthy, patients who have previously been diagnosed with a severe type of periodontitis may experience reduced implant survival, increased peri-implant bone loss, and a larger incidence of peri-implantitis. Another intriguing point found in a study is the fact that the type of periodontitis also plays a role in the outcome of dental implants. It concluded that patients who present aggressive periodontitis display worse survival/success rates and more bone loss than those with chronic periodontitis. To ensure the long-term survival of implants, it is advised to maintain a healthy lifestyle with good management of glycemic levels and avoiding risk factors such as smoking. Additionally, dental implants must be cleansed everyday by means of toothbrushes and interdental aids to eliminate biofilm (11,21).

#### PATIENT MOTIVATION

The role of the dentist in motivating and educating the patient on how to maintain effective oral hygiene outside of the clinic is crucial for obtaining a good prognosis in the control of periodontitis, as has been demonstrated in a study that concluded that there is an inverse correlation between motivation and extent of chronic periodontal disease (22). When asking patients about their oral hygiene techniques, it is important to correct them and show them how to improve them. Appropriate measures would include using an electric tooth brush instead of a manual one, brushing two to three times a day (using the correct technique). Additional hygienic measures include flossing and using mouthwash once a day before going to sleep, using interdental brushes or oral irrigators such as Waterpik® in cases where the patient presents braces, implants, crowns, bridges, or periodontal pockets (11,23). The use of Waterpik® is not only limited to patients who struggle to clean interdentally. A study has namely proven it to be twice as effective as regular brushing and flossing for removing supragingival plaque and improving gingival health (24). The use of a

water flosser additionally to manual toothbrushing has been proven to be more effective for improving gingival health than manual brushing alone, as revealed by the results of a randomized controlled trial (25). Additionally, even though most people would consider themselves to know how to brush and floss their teeth properly, there are many who do not know the right techniques and should therefore get them demonstrated by their dentists. A common way to do so is by displaying the different methods such as the “Bassman” technique and the suitable flossing technique on a typodont, which will give the patient a visual understanding of them. To make sure the correct techniques have been acquired, the patient can demonstrate them back to the dentist. Furthermore, it is vital to explain the physiological processes that happen in our bodies and our mouths that contribute to periodontitis (based or not on harmful habits). Providing a better background of the disease will help patients comprehend how to manage it, as they will become more aware of the consequences and will also properly understand the importance of avoiding risk factors and maintaining effective hygiene measures, which in turn will favour treatment success and patient outcomes. Of course, the collaboration of the patient is crucial, however, it is in the hands of the dentist to advise them against harmful habits and motivate patients not to smoke or to encourage smokers to quit. Since motivation may vary over time or from one circumstance to another, a lack of it is rather viewed as something that can be changed and adapted as opposed to an inborn personality trait (11,26).

## HARMFUL HABITS

It is worth noting that the perception of a habit can be a subjective thing. The use of tobacco products, alcohol, or a diet that is high in sugar are widely seen as harmful habits, whereas on the flipside, there are also generally well-perceived habits such as brushing your teeth regularly or regular exercise. The other perception of habits can be a lack of them, for example someone who does not brush their teeth everyday would be in the habit of not brushing their teeth, much like someone that does not use floss, mouthwash, or does not get regular check-ups, is in the habit of not doing so, which should also be regarded as exhibiting harmful habits. These habits can contribute to the development of

bacterial infections in the gums, which can lead to periodontitis if left untreated. Therefore, it is essential to maintain a good oral hygiene and avoid these risk factors to reduce the risk of developing periodontitis. As mentioned earlier, uncontrollable factors (gender, genetics, age, etc.) also play an important role as these can also increase the likelihood of suffering from periodontal disease, however, these are not considered “harmful habits” and so will not be included as contributing factors in this research (4).

## **OBJECTIVES**

### Primary objective:

- To assess the self-perception of periodontal changes in the oral cavity based on different harmful habits.

### Secondary objectives:

- To gain a better understanding about the significance of different risk factors and the role each of them play in the progression of periodontal disease.
- To discuss different approaches on how to reduce the risk of developing periodontitis, considering the patients' habits.

## **MATERIALS AND METHODS**

To carry out this research, an online questionnaire has been prepared and distributed amongst different random individuals in the world. The questionnaire consists of ten simple multiple-choice questions that the participants have answered anonymously. The questions are related to their oral health and include questions associated to their oral hygiene measures, any harmful habits they might present, and different periodontal changes they might perceive in their oral cavities. With the help of their responses, it was possible to observe whether they are aware of any undesirable changes in their mouths, considering the different oral habits they keep. Plotting the data into charts and tables has facilitated spotting meaningful results that could or could not mean

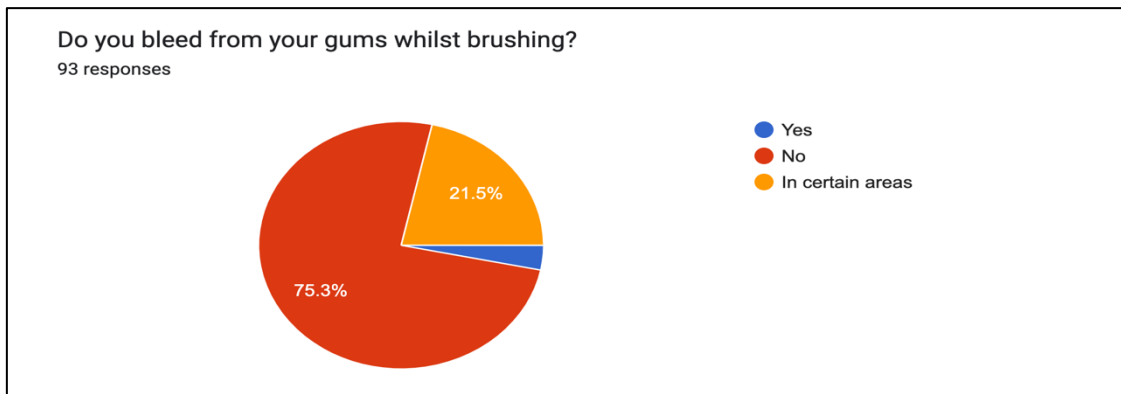
that there are patterns between the self-perception of periodontal alterations and certain harmful habits.

Additionally, reliable scientific information has been analyzed from different books and articles using the MedLine and NCBI database, which has helped enormously to validate and back up the results arisen from this research.

## RESULTS

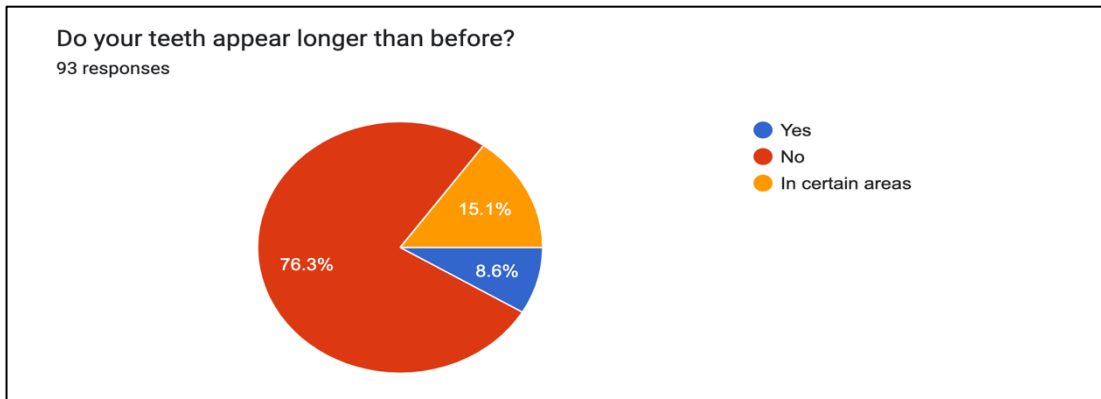
Presented below, are all the results that have been gathered through the online questionnaire. 93 responses were obtained in total. *Figures 3-12* display pie charts showing the total percentage of all the answers that were collected for each question.

As we can observe on the *Figure 3* display below, most participants do not bleed from their gums (75.3%), while 21.5% bleed from them in certain areas, and 3.2% bleed from them in a more generalized manner.



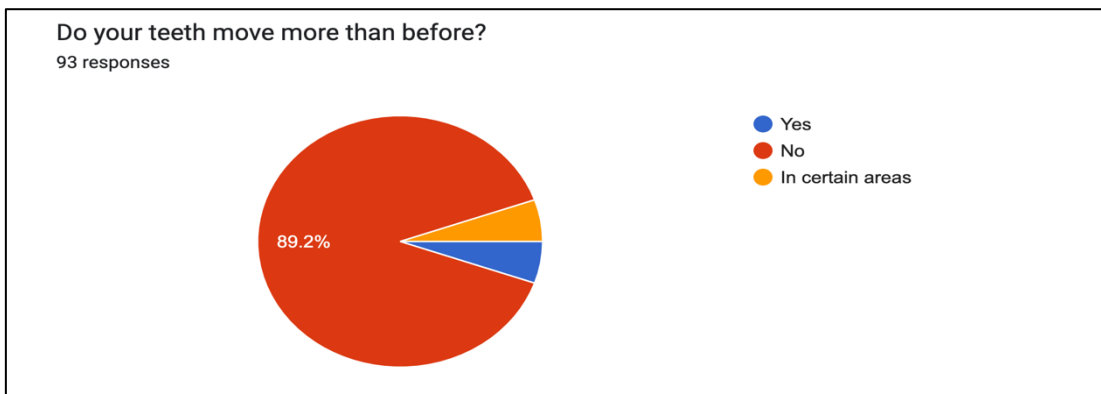
**Figure 3** Question 1 – % of participants reporting gingivitis.

*Figure 4* shows that 8.6% of subjects claim their teeth appear longer than before, while 15.1% claim they do so in certain areas, and 76.3% say they do not do so at all.



**Figure 4** Question 2 – % of participants reporting gum recession.

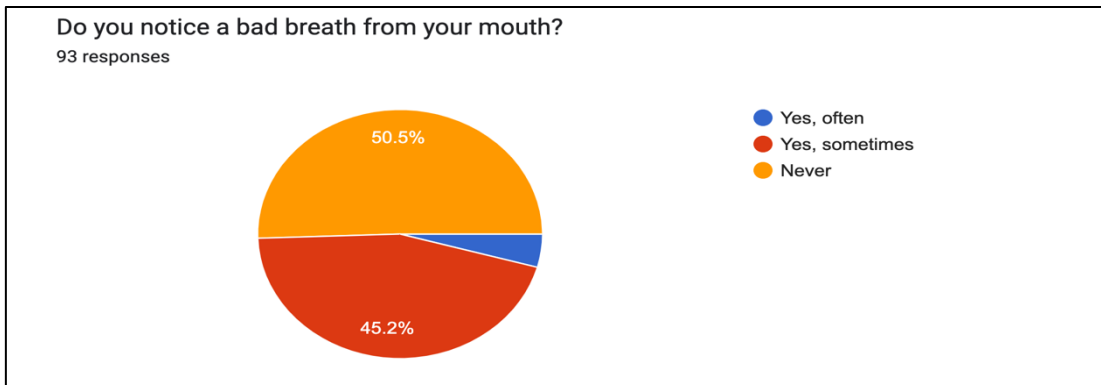
As we can see on *Figure 5*, 89.2% of subjects have not noticed any changes in tooth mobility, while it has in fact been perceived in a generalized form in 5.4% of participants and 5.4% in a localized form.



**Figure 5** Question 3 – % of participants reporting tooth mobility.

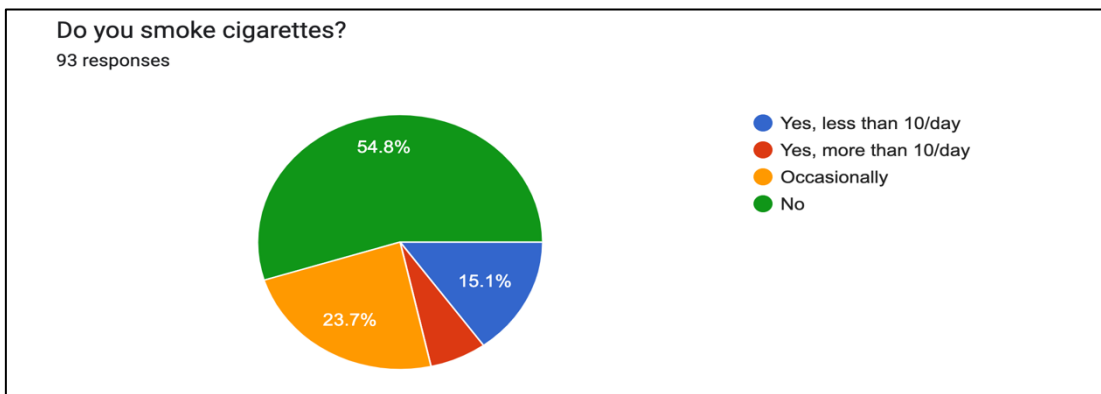
Regarding bad breath (halitosis), 50.5% say they never experience it, while 45.2% do so sometimes and 4.3% do so more often, as shown in *Figure 6* below.





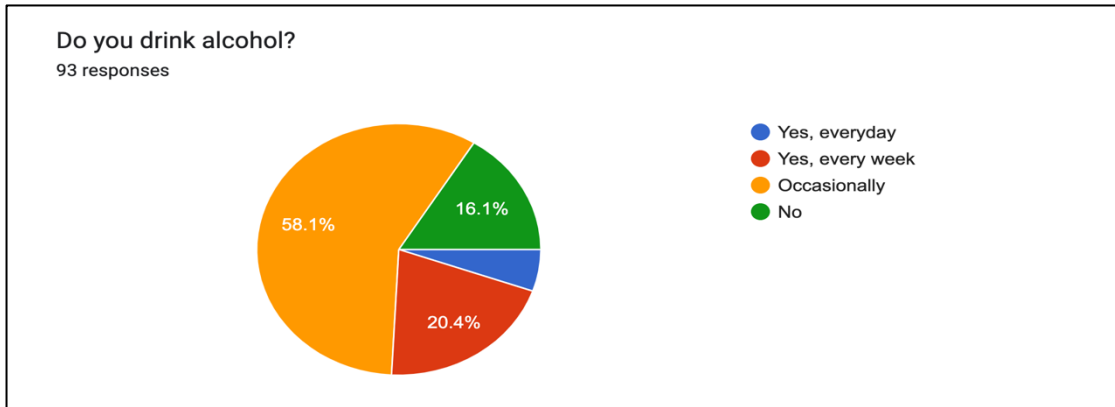
**Figure 6** Question 4 – % of participants reporting halitosis.

Figure 7 represents the smoking frequency among subjects and shows that 54.8% of the participants are non-smokers, 23.7% are occasional smokers, 15.1% smoke less than 10 cigarettes a day, and 6.5% smoke more than 10 cigarettes a day.



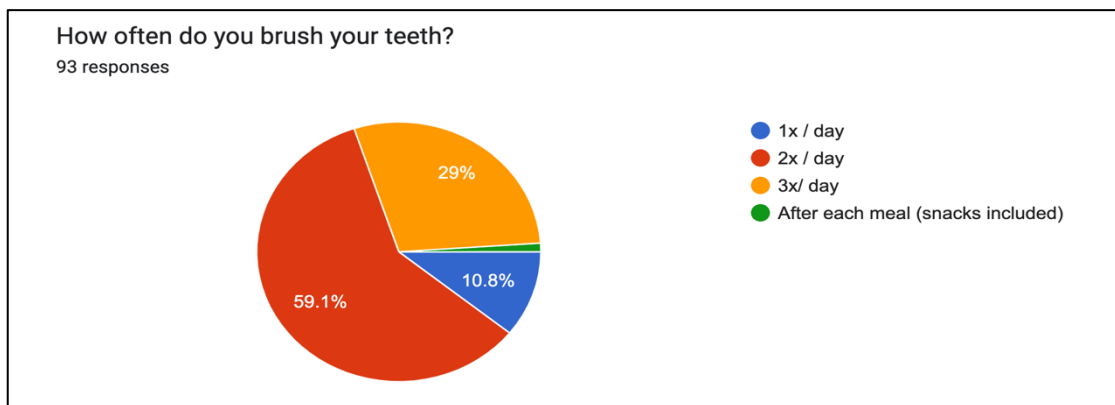
**Figure 7** Question 5 – % of smokers amongst participants.

Question 6 asks about the frequency of alcohol consumption among participants. As we can observe on Figure 8, 58.1% report to be occasional drinkers, 20.4% drink at least once every week, 5.4% drink every day and 16.1% do not drink alcohol at all.



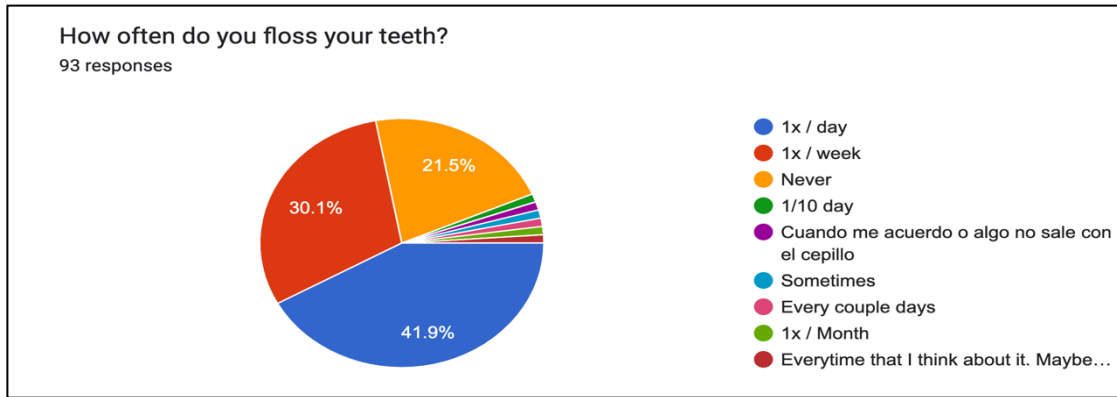
**Figure 8** Question 6 – % of alcohol consumption amongst participants.

Concerning hygiene techniques, 59.1% report that they brush their teeth twice a day, while 29% do so thrice a day, 10.8% once a day, and 1.1% brush after each meal, as can be seen in *Figure 9* exhibited below.



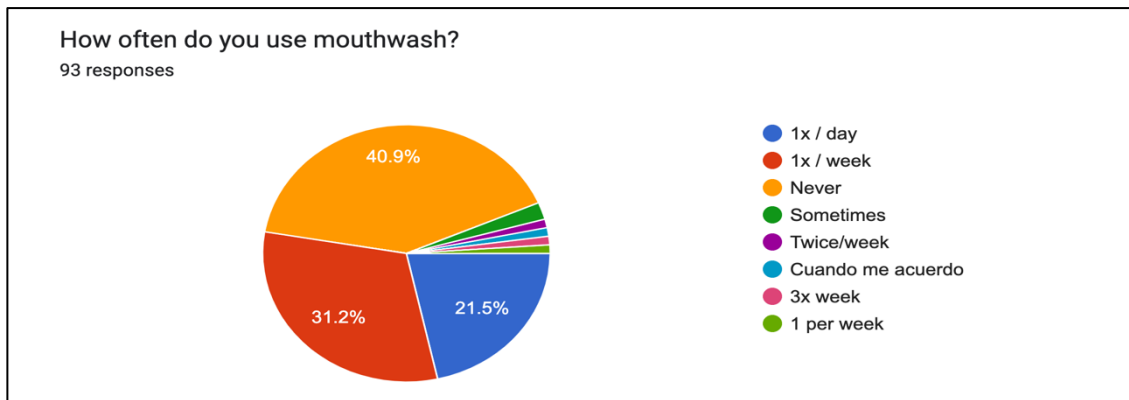
**Figure 9** Question 7 – % of tooth brushing frequency amongst participants.

According to *Figure 10*, 41.9% of participants say they floss once a day, 30.1% floss once a week, and 21.5% never floss. 2.2% floss when they remember, 1.1% floss sometimes, 1.1% floss once every 10 days, 1.1% floss every couple of days, and 1.1% floss once a month. For obtaining more accurate results, the small percentages of this question (i.e.,  $\leq 2.2\%$ ) have been interpreted and grouped together as irregular flossers as can be seen in table 4. These make up 6.5% of subjects.



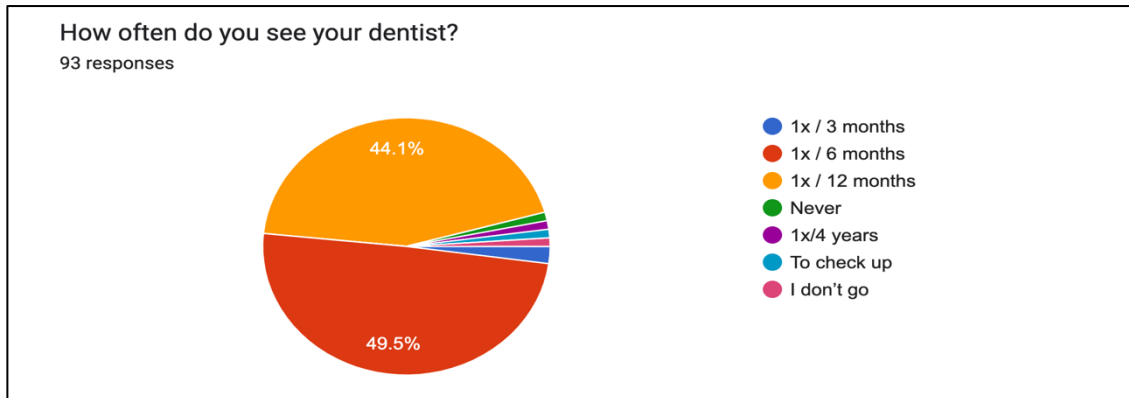
**Figure 10** Question 8 – % of tooth flossing frequency amongst participants.

Figure 11 represents the mouthwashing frequency and shows that 40.9% never use it, 32.3% use it once a week, and 21.5% use it every day. 2.2% use it sometimes, 1.1% use it twice a week, 1.1% thrice a week, and 1.1% when they remember (which will be categorized as “sometimes”).



**Figure 11** Question 9 – % of mouthwashing frequency amongst participants.

We can see that 49.5% of participants see their dentist every 6 months, whereas 44.1% see them every 12 months. 2.2% visit their dentist every 3 months, 1.1% once every 4 years, 1.1% go when they need a check-up, and 2.2% never visit the dentist at all, as observed on Figure 12.



**Figure 12** Question 10 – % of dental visit frequency amongst participants.

Tables 1-6 presented below display frequency tables representing a more in-depth look at the self-perception of the oral health and different harmful habits of each individual.

**Table 1.** Self-perception of oral health and smoking.

	<b>Bleeding gums</b>	<b>Teeth appear longer</b>	<b>Teeth appear to move</b>	<b>Bad breath (halitosis)</b>
<b>Non- smokers</b>	23.5%	23.5%	9.8%	41.2%
<b>Occasional</b>	31.8%	22.7%	9.1%	59.1%
<b>&lt;10 cig. /Day</b>	28.6%	28.6%	21.4%	64.3%
<b>&gt;10 cig. /Day</b>	0%	16.7%	0%	50%

**Table 2.** Self-perception of oral health and alcohol consumption.

	<b>Bleeding gums</b>	<b>Teeth appear longer</b>	<b>Teeth appear to move</b>	<b>Bad breath (halitosis)</b>
<b>Non- drinkers</b>	20%	0%	0%	33.3%
<b>Occasional</b>	31.5%	24.1%	9.3%	48.1%
<b>Every week</b>	10.5%	26.3%	15.8%	57.9%
<b>Every day</b>	20%	80%	40%	80%

**Table 3.** Self-perception of oral health and tooth brushing frequency.

	<b>Bleeding gums</b>	<b>Teeth appear longer</b>	<b>Teeth appear to move</b>	<b>Bad breath (halitosis)</b>
<b>Once a day</b>	50%	20%	20%	70%
<b>Twice a day</b>	21.8%	25.5%	9.1%	56.4%
<b>Thrice a day</b>	22.2%	22.2%	11.1%	29.6%
<b>After each meal</b>	0%	0%	0%	0%

**Table 4.** Self-perception of oral health and tooth flossing frequency.

	<b>Bleeding gums</b>	<b>Teeth appear longer</b>	<b>Teeth appear to move</b>	<b>Bad breath (halitosis)</b>
<b>Once a day</b>	33.3%	25.6%	15.4%	61.5%
<b>Once a week</b>	32.1%	25%	7.1%	42.9%
<b>Never</b>	25%	25%	10%	35%
<b>Sometimes</b>	33.3%	0%	0%	50%

**Table 5.** Self-perception of oral health and mouthwashing frequency.

	<b>Bleeding gums</b>	<b>Teeth appear longer</b>	<b>Teeth appear to move</b>	<b>Bad breath (halitosis)</b>
<b>Once a day</b>	20%	40%	30%	55%
<b>Once a week</b>	30%	13.3%	10%	80%
<b>Twice a week</b>	0%	0%	0%	0%
<b>Thrice a week</b>	0%	0%	0%	0%
<b>Never</b>	10.5%	26.3%	15.8%	57.9%
<b>Sometimes</b>	20%	80%	40%	80%

**Table 6.** Self-perception of oral health and dental visit frequency.

	<b>Bleeding gums</b>	<b>Teeth appear longer</b>	<b>Teeth appear to move</b>	<b>Bad breath (halitosis)</b>
<b>1x/3 months</b>	0%	50%	50%%	100%
<b>1x/6 months</b>	17.4%	21.7%	6.5%	43.5%
<b>1x/12 months</b>	34.1%	26.8%	14.6%	53.7%
<b>1x/4 years</b>	0%	0%	0%	0%
<b>Never</b>	50%	0%	0%	50%
<b>When need a check-up</b>	0%	0%	0%	0%

## **DISCUSSION**

As we have mentioned, periodontitis can be diagnosed both clinically (measuring probing depths, tooth mobility, etc.) and radiographically but has unfortunately not been able to be the case in this research, as participants have only been handed an online questionnaire and have not actually been examined for periodontitis in a dental clinic. For this reason, their responses have been used to assess what periodontal changes they may have detected on themselves based on different harmful habits, rather than to evaluate if there is any statistical correlation between periodontitis and harmful habits, which was one of the initial objectives of this research project. When assessing the results of the questionnaire, we must take into account that all the answers given by the participants may or may not represent the reality of the situation. Additionally, it is important to note that the provided responses are subjective, as patients have diverse methods and interpretations to establish a self-diagnosis for themselves. Moreover, as stated earlier, periodontitis can also be linked to other factors such as age, genetics, and other underlying medical conditions that have not been considered in this study and could be the reason behind some of the findings. Also, knowing if the adverse periodontal alterations

are perceived in a localized or generalized form (answered by “in certain areas” / “yes” respectively), can help indicate if they could be related to other factors such as food impaction, or ineffective brushing or flossing techniques that do not clean the surfaces of all teeth.

As can be seen on *Table 1*, the prevalence of individuals that perceive periodontal alterations in their oral cavity is generally higher in smokers than in non-smokers. There were no reported cases of bleeding gums in subjects that smoke more than 10 cigarettes, which is consistent with the fact that nicotine causes stimulation of the sympathetic nervous system, causing vasoconstriction of blood vessels, thus decreasing gingival blood flow (27). However, the number of daily cigarettes also seems to play a role as there have been several cases of smokers who do in fact experience gingivitis. This can be because those subjects exhibit additional harmful habits, such as poor oral hygiene or an unhealthy diet, to name a few. It has also been shown that those who already present a harmful habit such as smoking, are more likely to acquire another one (4). Smokers also reported the highest percentage of noticing longer teeth, increased tooth mobility and halitosis, which are all potential signs of periodontal disease. Although gingival inflammation is reduced in smokers, smoking has shown to worsen periodontal bone loss, which could have to do with the immunosuppressive effects arising from the impaired host response (27). Besides periodontal-related changes in teeth, cigarette smoking is also known to pose other serious health threats to the population such as respiratory problems, cardiovascular diseases, and cancer (11,28).

If we have a look at *Table 2*, we can see that the presence of all the four periodontal parameters is equal to or higher in those that consume alcohol, than in those who don't (with one exception). Although those that drink alcohol every week seem to present less cases of bleeding gums than those who abstain from it (10,5% and 20,5% respectively), we can also see that the weekly drinkers also conduct appropriate oral hygiene measures that could counteract its damage to some extent. Alcohol consumption is considered an important risk factor in the evolution and the severity of periodontitis by intensifying the inflammatory response and increasing osteoclastogenesis, which resorbs the bone (4,11,29). As can be seen in the same table, those who drink everyday



also reported the highest frequency of gum recession, tooth mobility, and halitosis. Alcohol has also been shown to dehydrate the mouth by decreasing salivary flow, thereby creating an imbalance of pH in the oral flora and inhibiting its protective functions. Studies also link alcohol to gum disease and halitosis, which is coherent with the results that have been obtained. Finally, through the decreased salivary flow, we are more susceptible to caries, which if left untreated, can eventually lead to periodontitis and further complications (30).

The reported tooth brushing frequency also seems to show some sort of connection to self-perceived periodontal changes in the mouth as can be drawn from *Table 3*. Participants who brushed their teeth once a day experienced more cases of gingivitis, tooth mobility, and halitosis, reported however less cases of longer teeth than those who brushed two or three times a day, which could be due to inadequate brushing techniques employed several times every day (9). Another interesting point that could contribute to this result is the fact that 80% of those who brushed once a day, also floss at least once a day, which also decreases the likelihood of experiencing gum recession.

Although flossing has been proven to reduce the chance of suffering from periodontal alterations in the oral cavity, the results obtained for this question stated quite the contrary (*Table 4*). Flossing in the correct manner can seem very challenging for patients if they have never been taught. Additionally, most of the subjects who reported flossing once a day also consume alcohol, which on the flipside, has been revealed in this study to increase the periodontal changes perceived by the participants.

## **CONCLUSION**

There seems to be a potential pattern between the self-perception of periodontal changes in the oral cavity based on the smoking, alcohol, tooth brushing frequency. Flossing every day did not seem to reduce signs of periodontal alterations. To confirm this, more in-depth research needs to be carried out exploring the causal relationships, using statistically significant data as supporting evidence.

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## ANNEXES

### Periodontal disease & Harmful habits

To evaluate if there is a correlation between prevalence of periodontal disease secondary to harmful habits amongst the general population.

Do you bleed from your gums whilst brushing? \*

- Yes
- No
- In certain areas

Do your teeth appear longer than before? \*

- Yes
- No
- In certain areas

Do your teeth move more than before? \*

- Yes
- No
- In certain areas

Do you notice a bad breath from your mouth? \*

- Yes, often
- Yes, sometimes
- Never

Do you smoke cigarettes? \*



- Yes, less than 10/day
- Yes, more than 10/day
- Occasionally
- No

Do you drink alcohol? \*

- Yes, everyday
- Yes, every week
- Occasionally
- No

How often do you brush your teeth? \*

- 1x / day
- 2x / day
- 3x / day
- Other...

How often do you floss your teeth? \*

- 1x / day
- 1x / week
- Never
- Other...

How often do you use mouthwash? \*

- 1x / day
- 1x / week
- Never
- Other..

How often do you see your dentist? \*

- 1x / 3 months
- 1x / 6 months
- 1x / 12 months
- Other..

1	Timestamp	Do you bleed from your gums?	Do your teeth appear looser?	Do your teeth move more than normal?	Do you notice a bad breath?	Do you smoke cigarettes?	Do you drink alcohol?	How often do you brush your teeth?	How often do you floss your teeth?	How often do you use mouthwash?	How often do you see your dentist?
2	12.24.2022 16:31:34	In certain areas	No	No	Never	Occasionally	Occasionally	2x / day	Never	1x / day	1x / 12 months
3	12.24.2022 17:02:44	No	No	No	Never	Yes, more than 10/day	Occasionally	2x / day	Never	1x / day	Never
4	12.24.2022 17:03:34	No	No	No	Yes, sometimes	Yes, more than 10/day	Yes, every week	2x / day	1x / day	1x / day	1x / 12 months
5	12.24.2022 17:03:45	No	No	No	Never	No	No	After each meal/snacks in	1x / day	1x / day	1x / 6 months
6	12.24.2022 17:04:52	No	No	No	Never	Yes, more than 10/day	Yes, every week	2x / day	1x / day	1x / day	1x/4 years
7	12.24.2022 17:05:38	In certain areas	Yes	No	Yes, often	Occasionally	Occasionally	1x / day	1x / day	1x / day	1x / 12 months
8	12.24.2022 17:06:10	No	No	No	Yes, sometimes	Occasionally	Yes, every week	2x / day	1x / day	1x / day	1x / 6 months
9	12.24.2022 17:07:28	No	No	No	Never	No	No	3x / day	Never	1x / week	1x / 12 months
10	12.24.2022 17:08:23	No	Yes	No	Never	Yes, less than 10/day	Occasionally	3x / day	1x / week	1x / week	1x / 6 months
11	12.24.2022 17:08:25	No	No	No	Never	No	Occasionally	3x / day	1x / day	1x / day	1x / 6 months
12	12.24.2022 17:08:27	No	No	No	Yes, sometimes	Yes, more than 10/day	Occasionally	3x / day	1x / week	1x / week	1x / 6 months
13	12.24.2022 17:08:28	No	No	No	Yes, sometimes	No	Occasionally	2x / day	1x / week	1x / week	1x / 6 months
14	12.24.2022 17:08:45	No	In certain areas	In certain areas	Yes, sometimes	Occasionally	Occasionally	2x / day	1x / day	1x / day	1x / 6 months
15	12.24.2022 17:08:46	No	In certain areas	No	Yes, sometimes	Occasionally	Occasionally	2x / day	1x / week	1x / week	1x / 12 months
16	12.24.2022 17:10:10	No	No	No	Never	Occasionally	Occasionally	3x / day	1x / day	1x / week	1x / 6 months
17	12.24.2022 17:10:45	No	No	No	Never	Occasionally	Yes, every week	2x / day	Never	Sometimes	1x / 6 months
18	12.24.2022 17:12:22	No	Yes	No	Yes, sometimes	No	Yes, every week	2x / day	1x / day	1x / day	1x / 12 months
19	12.24.2022 17:13:27	In certain areas	In certain areas	No	Never	No	Occasionally	2x / day	Never	Never	1x / 6 months
20	12.24.2022 17:13:31	No	No	No	Never	No	Yes, every week	1x / day	1x / week	1x / week	1x / 6 months
21	12.24.2022 17:13:32	No	No	No	Yes, sometimes	Occasionally	Yes, every week	2x / day	1x / day	1x / day	1x / 6 months
22	12.24.2022 17:16:42	No	Yes	No	Yes, sometimes	No	Occasionally	3x / day	1x / day	1x / day	1x / 12 months
23	12.24.2022 17:23:15	In certain areas	In certain areas	No	Never	No	Occasionally	2x / day	1x / day	1x / day	1x / 12 months
24	12.24.2022 17:23:25	No	No	No	Never	No	Occasionally	3x / day	1x / day	1x / day	1x / 6 months
25	12.24.2022 17:24:31	No	In certain areas	In certain areas	Yes, sometimes	Occasionally	Yes, every week	2x / day	Never	Never	1x / 12 months
26	12.24.2022 17:25:10	No	No	In certain areas	Yes, sometimes	Yes, less than 10/day	Yes, every week	2x / day	1x / day	1x / week	1x / 12 months
27	12.24.2022 17:33:50	No	In certain areas	No	Never	No	Occasionally	2x / day	1x / week	1x / week	1x / 6 months
28	12.24.2022 17:35:02	In certain areas	No	No	Never	No	Occasionally	3x / day	1x / week	1x / week	1x / 12 months
29	12.24.2022 17:36:09	In certain areas	No	No	Yes, sometimes	Occasionally	Occasionally	2x / day	1x / week	1x / week	1x / 12 months
30	12.24.2022 17:41:07	No	No	No	Yes, sometimes	Occasionally	Occasionally	2x / day	1x / week	1x / week	1x / 12 months
31	12.24.2022 17:41:52	In certain areas	No	No	Never	Occasionally	Occasionally	2x / day	1x / week	1x / week	1x / 12 months
32	12.24.2022 17:44:17	No	No	No	Never	Yes, less than 10/day	Occasionally	2x / day	1x / week	1x / day	1x / 6 months
33	12.24.2022 17:46:34	No	No	No	Yes, sometimes	Occasionally	No	2x / day	1x / day	1x / day	1x / 12 months
34	12.24.2022 17:49:41	No	No	No	Never	No	Occasionally	2x / day	1x / week	1x / week	1x / 6 months
35	12.24.2022 17:50:55	No	In certain areas	No	Never	No	Yes, every week	2x / day	1x / day	1x / day	1x / 6 months
36	12.24.2022 17:51:56	No	No	No	Never	Occasionally	Occasionally	2x / day	1/10 day	Twice/week	To check up
37	12.24.2022 17:56:57	No	No	No	Yes, sometimes	Occasionally	Yes, every week	2x / day	1x / day	1x / week	1x / 12 months
38	12.24.2022 17:57:45	No	No	No	Never	Yes, less than 10/day	Occasionally	3x / day	1x / week	1x / week	1x / 6 months
39	12.24.2022 18:12:38	No	No	No	Never	No	No	2x / day	1x / week	1x / week	1x / 6 months
40	12.24.2022 18:18:38	In certain areas	No	No	Never	Occasionally	Occasionally	3x / day	1x / week	1x / week	1x / 12 months
41	12.24.2022 18:23:17	No	No	No	Yes, sometimes	Yes, less than 10/day	Yes, every week	2x / day	Quando me acuerdo o al día	Quando me acuerdo	1x / 6 months
42	12.24.2022 18:23:18	In certain areas	No	No	Yes, sometimes	No	Occasionally	2x / day	1x / day	1x / week	1x / 6 months
43	12.24.2022 18:55:53	No	No	No	Never	Occasionally	Occasionally	2x / day	Sometimes	Sometimes	1x / 6 months
44	12.24.2022 19:01:55	No	No	No	Yes, sometimes	Occasionally	No	2x / day	Never	1x / week	1x / 6 months
45	12.24.2022 19:12:08	In certain areas	No	No	Yes, sometimes	Yes, less than 10/day	Occasionally	2x / day	1x / week	1x / week	1x / 6 months
46	12.24.2022 19:28:19	In certain areas	No	No	Never	No	No	2x / day	Every couple days	Never	1x / 6 months
47	12.24.2022 19:36:42	No	No	No	Yes, sometimes	No	Occasionally	2x / day	1x / week	1x / week	1x / 12 months
48	12.24.2022 19:39:09	No	No	No	Never	No	Occasionally	2x / day	Never	1x / week	1x / 12 months
49	12.24.2022 20:00:25	Yes	No	No	Never	No	Occasionally	2x / day	1x / week	1x / week	1x / 12 months
50	12.24.2022 20:10:16	No	No	No	Never	Yes, less than 10/day	Yes, every week	2x / day	1x / week	1x / week	1x / 6 months
51	12.24.2022 21:09:00	No	No	No	Never	Yes, more than 10/day	Occasionally	3x / day	1x / day	1x / day	1x / 12 months
52	12.24.2022 21:37:41	No	Yes	No	Yes, sometimes	Yes, less than 10/day	Yes, everyday	2x / day	1x / week	1x / day	1x / 6 months
53	12.24.2022 21:49:03	No	No	No	Never	No	Yes, every week	2x / day	1x / week	1x / week	1x / 6 months
54	12.24.2022 22:07:04	No	No	No	Never	No	Yes, every week	2x / day	1x / day	1x / day	1x / 12 months
55	12.24.2022 22:08:01	No	No	No	Never	No	No	2x / day	1x / day	1x / day	1x / 6 months
56	12.24.2022 22:37:43	No	No	No	Yes, sometimes	Occasionally	Occasionally	2x / day	1x / Month	Never	1x / 12 months
57	12.24.2022 23:09:29	In certain areas	No	No	Never	Occasionally	Occasionally	3x / day	1x / week	1x / day	1x / 12 months
58	12.24.2022 23:16:31	In certain areas	No	No	Yes, often	Occasionally	Yes, every week	2x / day	Everytime that I think about	1x / week	1x / 12 months
59	12.24.2022 23:39:16	In certain areas	Yes	In certain areas	Yes, sometimes	Yes, less than 10/day	Yes, every week	1x / day	1x / day	1x / day	1x / 12 months
60	12.25.2022 0:51:28	Yes	No	No	Yes, sometimes	Yes, less than 10/day	Occasionally	1x / day	Never	1x / day	1 day/10
61	12.25.2022 1:28:45	No	No	No	Never	No	Occasionally	3x / day	Never	1x / day	1x / 12 months
62	12.25.2022 1:48:11	No	No	No	Never	No	No	1x / day	1x / day	1x / day	1x / 6 months
63	12.25.2022 1:58:23	In certain areas	No	Yes	Yes, often	Yes, less than 10/day	Yes, everyday	2x / day	1x / day	1x / day	1x / 6 months
64	12.25.2022 2:14:30	No	No	No	Yes, sometimes	No	Occasionally	2x / day	1x / day	1x / day	1x / 12 months
65	12.25.2022 2:25:52	No	No	No	Never	Yes, less than 10/day	Yes, every week	3x / day	1x / day	3x / week	1x / 6 months
66	12.25.2022 2:30:30	No	No	No	Never	No	No	3x / day	Never	1x / week	1x / 6 months
67	12.25.2022 2:37:07	No	In certain areas	No	Yes, sometimes	No	Yes, every week	2x / day	1x / day	1x / day	1x / 6 months
68	12.25.2022 2:42:30	No	Yes	No	Yes, sometimes	Yes, less than 10/day	Occasionally	2x / day	1x / day	1x / day	1x / 6 months
69	12.25.2022 2:42:40	No	No	No	Yes, sometimes	No	Occasionally	2x / day	1x / day	1x / day	1x / 6 months
70	12.25.2022 2:45:32	No	No	No	Yes, sometimes	No	Occasionally	2x / day	1x / week	1x / week	1x / 12 months
71	12.25.2022 2:45:58	No	No	No	Yes, sometimes	Yes, less than 10/day	No	2x / day	1x / day	1x / day	1x / 6 months
72	12.25.2022 2:45:58	No	No	No	Never	No	Occasionally	3x / day	1x / day	1x / day	1x / 6 months
73	12.25.2022 2:50:00	No	No	No	Never	Occasionally	Occasionally	1x / day	1x / day	1x / day	1x / 12 months
74	12.25.2022 2:52:34	No	In certain areas	No	Yes, sometimes	Yes, more than 10/day	Yes, everyday	2x / day	1x / week	1x / week	1x / 12 months
75	12.26.2022 1:10:44	No	No	No	Never	No	No	3x / day	1x / week	1x / week	1x / 12 months
76	12.26.2022 1:10:27	No	No	No	Never	No	Occasionally	3x / day	1x / week	1x / week	1x / 6 months
77	12.26.2022 1:30:21	No	No	No	Never	No	Occasionally	3x / day	1x / day	1x / week	1x / 12 months
78	12.27.2022 20:46:37	No	No	No	Yes, sometimes	No	Occasionally	2x / day	1x / day	1x / day	1x / 12 months
79	12.27.2022 20:52:34	No	No	No	Never	No	No	3x / day	1x / day	1x / week	1x / 12 months
80	12.27.2022 20:56:33	In certain areas	No	No	Yes, sometimes	No	No	1x / day	1x / day	1x / day	1x / 6 months
81	12.27.2022 21:05:15	In certain areas	In certain areas	No	Yes, sometimes	No	Occasionally	3x / day	1x / week	1x / day	1x / 12 months
82	12.27.2022 21:26:12	No	No	No	Never	No	Occasionally	2x / day	1x / week	1x / week	1x / 12 months
83	12.27.2022 21:40:08	No	No	No	Yes, sometimes	No	1x / day	1x / day	1x / week	1x / week	1x / 6 months
84	12.27.2022 21:45:20	No	No	No	Yes, sometimes	No	Occasionally	3x / day	1x / day	1x / day	1x / 6 months
85	12.27.2022 21:45:18	No	No	No	Yes, sometimes	No	Occasionally	1x / day	1x / day	1x / day	1x / 6 months
86	12.27.2022 22:07:10	No	No	No	Yes, sometimes	No	Occasionally	3x / day	Never	Never	1x / 12 months
87	12.27.2022 22:32:18	In certain areas	No	Yes	Yes, sometimes	No	Occasionally	1x / day	1x / day	1x / day	1x / 12 months
88	12.28.2022 1:11:44	Yes	No	No	Yes	No	2x / day	1x / day	1 per week	1x / day	1x / 6 months
89	12.28.2022 4:15:41	No	In certain areas	Yes	Yes, sometimes	No	Occasionally	2x / day	1x / day	1x / week	1x / 6 months
90	12.28.2022 4:30:58	In certain areas	No	No	Yes, sometimes	No	Occasionally	3x / day	1x / day	1x / week	1x / 6 months
91	12.28.2022 19:47:43	In certain areas	Yes	Yes	Yes, often	No	Occasionally	3x / day	1x / week	1x / week	1x / 12 months
92	12.29.2022 17:19:16	No	Yes	Yes	Yes, sometimes	No	Yes, everyday	3x / day	1x / day	1x / day	1x / 3 months
93	12.29.2022 17:28:15	No	In certain areas	No	Never	No	Yes, everyday	3x / day	1x / day	1x / day	1x / 6 months
94	12.29.2022 21:16:35	No	No	No	Never	No	Occasionally	3x / day	1x / day	1x / week	1x / 12 months