Oral hygiene habits in patients taking glucagon like peptide-1 analogues

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ABSTRACT
Introduction: Patients with unstable blood glucose levels require particular attention to oral hygiene due to diabetes-related symptoms and pharmacotherapies, including glucagon-like peptide-1 (GLP-1) receptor agonists. These agents may modify the oral environment, potentially affecting the incidence of dental and periodontal pathologies.
The aim of this study was to assess oral hygiene among patients using GLP-1 analogues, taking into account their side effects and testing the hypothesis that GLP-1 therapy might be associated with inadequate oral care.
Materials and methods: An anonymous survey (26 questions) regarding general health, oral hygiene practices, and ongoing pharmacotherapy was shared via social media groups of patients taking GLP-1 analogues. Responses concerning hygiene habits, use of dental aids, and the occurrence of oral lesions were collected and analyzed.
Results: Most respondents reported adherence to recommended oral hygiene routines. However, a noticeable increase in aphthous ulcers was observed during periods of gingivitis/periodontal disease compared to before GLP-1 analogue therapy. This could suggest that GLP-1 medications influence the oral environment, potentially exacerbating inflammatory changes when hygiene or regular dental check-ups are insufficient.
Conclusion: The findings highlight the need for more frequent dental check-ups and heightened awareness of daily oral hygiene among patients on GLP-1 therapy. Preventive measures and early intervention may help mitigate the risk of periodontal complications.
Keywords: oral hygiene; diabetes; blood glucose level; GLP-1 analogue; glucagon-like peptide-1 receptor agonists.

INTRODUCTION

Fluctuations in blood glucose levels affect, among other systems, the oral cavity and its mucosa [1]. Hypoglycemia may lead to oral dryness, increasing the risk of dental caries due to reduced salivary flow and protection [2]. Saliva plays a crucial buffering role, maintaining biofilm pH near neutral and supporting beneficial oral bacteria [3]. It also contains antimicrobial molecules (e.g., antimicrobial peptides, mucins, proline-rich proteins), representing the first line of defense against pathogens [4]. Uncontrolled glycemia correlates with a higher incidence of gingivitis [5], and this 2-way interplay means that diabetes adversely impacts periodontal health, while periodontal disease itself hinders proper glycemic control [6].

Patients with diabetes or prediabetes thus require intensified oral hygiene monitoring. Basic periodontal disease prevention relies on systematic toothbrushing and cleaning of interdental spaces [7]. Ineffective plaque removal fosters the proliferation of Gram– anaerobic bacteria and initiates host responses implicated in periodontal inflammation [8]. Despite the availability of various oral hygiene tools (e.g., different toothbrushes, interdental brushes, dental floss), many individuals still neglect cleaning interdental areas, resulting in insufficient oral care [9].

Moreover, patients receiving glucagon-like peptide-1 (GLP-1) analogues form a group that may face distinct side effects, such as gastrointestinal discomfort, which could indirectly influence their oral hygiene habits (e.g., through nausea or altered dietary behaviors). The aim of this study was to examine the impact of GLP-1 receptor agonist therapy on oral hygiene practices and oral health outcomes, hypothesizing that patients receiving GLP-1 analogues may be at increased risk of oral complications if preventive care is inadequate.

Individuals requiring special attention and supervision in oral hygiene include patients with systemic conditions or those receiving particular medications [10]. Notably, diabetic patients often use pharmacological agents such as semaglutide or liraglutide – both belonging to the class of GLP-1 receptor agonists [11]. These drugs can exert a dual, and sometimes ambivalent, effect on periodontal health. Therefore, the present study focused on patients undergoing GLP-1 therapy, evaluating their oral hygiene practices in order to test the hypothesis that GLP-1 users may have inadequate hygiene behaviors or heightened susceptibility to oral complications.

MATERIALS AND METHODS

Study design and participants

This research was carried out using an anonymous survey distributed via a Google Form link shared on social media groups

dedicated to individuals from Poland taking GLP-1 analogues. Only patients who self-reported the use of GLP-1 agonists were eligible to participate. In total, 339 patients aged 21–30 through 61–70 completed the questionnaire.

Survey instrument

The survey comprised 26 questions, of which 5 gathered demographic and personal data while the remaining 21 inquired about medications used and potential oral side effects. Participants were asked to specify:
- drug-related information: the exact GLP-1 formulation, dosage, route of administration, duration of use, indication for therapy (e.g., type 2 diabetes, insulin resistance, weight management), and coexisting conditions,
- adverse effects: whether they experienced any undesirable symptoms related to oral health, such as bleeding gums, aphthous lesions, erosions, gingival swelling, peeling of the oral mucosa, herpes outbreaks, angular cheilitis, gum pain, or xerostomia,
- oral hygiene and lifestyle: frequency of toothbrushing, use of interdental cleaning tools (e.g., floss, interdental brushes, oral irrigators), history of periodontal disease, use of removable dentures, and smoking status.

After 3 months, participants who had consented to follow-up received the same questionnaire by e-mail to enable comparison of results over time. The survey was completed independently by each respondent without supervision by dental professionals, meaning all data reflect the patients' subjective observations. The survey was voluntary, anonymous, and did not collect sensitive information beyond the scope of the study.

Statistical analyses

For continuous data, descriptive statistics (mean, median, standard deviation, first and third quartiles and range) were used to characterize the study group. Categorical data were summarized as absolute counts (n) and percentages. Because many variables did not follow a normal distribution, the Mann–Whitney U-test was used to compare differences between 2 independent groups. Associations among categorical variables were evaluated using either the chi-square test or Fisher's exact test, depending on sample sizes and distribution assumptions.

Where relevant, p-values < 0.05 were considered statistically significant. All analyses were performed using recognized statistical software packages, and results were interpreted in light of the study's main hypothesis – that GLP-1 therapy may be linked to alterations in oral hygiene practices and oral health outcomes.

RESULTS

In total, 339 individuals participated in the survey, of whom 97.6% were women. The largest age subgroup (40.4%) encompassed respondents aged 41–50, followed by those aged 31–40 (33.9%) and 51–60 (11.5%). Regarding educational attainment, 73.5% reported higher education, whereas only 1.2% had completed primary education. In terms of place of residence, 42.8% lived in a city of over 100,000 inhabitants, while 20.1% resided in rural areas.

Analysis of weight categories revealed that 18.6% of respondents with a primary goal of weight reduction had a body weight exceeding 100 kg, and the second-largest subset in this context (15.9%) weighed 80–85kg. Concerning pharmacotherapy, at least 75% of participants used only one GLP-1 agonist, though the maximum reported was 4 concurrent medications.

Medications
- Ozempic (semaglutide, subcutaneously) was the most common drug, used by 81.7% of respondents. The average reported dose was 10.85 (±74.75) mL,
- Rybelsus (semaglutide, orally) was taken by 5.6% of respondents, with a mean dose of 10.33 (±4.49) mg,
- Saxenda (liraglutide, subcutaneously) was reported by 14.5% of participants, although taken orally by a small minority; the mean daily dose was 1.78 (±0.79) mg,
- Victoza (liraglutide, subcutaneously) was used by only 2.4% of the survey group, with a mean dose of approx. 5 (±6.07) mg.

The most frequently reported duration of GLP-1 treatment (35.9%) ranged 3–4 months, followed by 7 months to 1 year (32.6%). Overall, 49.6% of participants cited insulin resistance as their main reason for starting GLP-1 therapy, while 62.8% pointed to obesity or being overweight (some respondents reported multiple reasons). About 29% of respondents used the medication for type 2 diabetes or prediabetes, and 3.8% indicated other reasons.

Adverse effects

Several side effects presumably associated with the therapy were recorded:
- increased gum bleeding (6.5%),
- swollen gums (6.5%),
- heightened incidence of aphthous ulcers or erosions (8.9%),
- mucosal peeling (2.7%),
- recurrent herpes (6.4%),
- more frequent angular cheilitis (10.4%),
- painful gums (10.6%),
- xerostomia – dry mouth (46.6%).

At least half of the respondents experienced 4 or more different side effects, with the highest recorded number being 9 per participant. Detailed characteristics of the study population and medication usage are summarized in Table 1.

TABLE 1. Characteristic of the study group

Variable	Parameter	Total (n = 339)
Gender	female	97.6% (n = 331)
	male	2.4% (n = 8)
Age (years)	21–30	11.5% (n = 39)
	31–40	33.9% (n = 115)
	41–50	40.4% (n = 137)
	51–60	11.5% (n = 39)
	61–80	2.7% (n = 9)
Education	primary	1.2% (n = 4)
	secondary	25.4% (n = 86)
	higher	73.5% (n = 249)
Place of residence	village	20.1% (n = 68)
	city <50,000 inhabitants	20.6% (n = 70)
	city 50,000–100,000 inhabitants	16.5% (n = 56)
	city >100,000 inhabitants	42.8% (n = 145)
Weight (kg)	50–60	5.0% (n = 17)
	60–70	13.6% (n = 46)
	70–80	25.7% (n = 87)
	80–90	16.5% (n = 56)
	90–100	20.7% (n = 70)
	>100	18.6% (n = 63)
Number of drugs	mean (SD)	1.04 (0.25)
	median (Q1–Q3)	1 (1–1)
	range	1–4
Ozempic (subcut.)	yes	81.7% (n = 277)
Rybelsus (oral)	yes	5.6% (n = 19)
Saxenda (subcut.)	yes	14.5% (n = 49)
Victoza (subcut.)	yes	2.4% (n = 8)
Ozempic dosage (subcut.)	mean (SD)	10.85 (74.75)
	median (Q1–Q3)	0.5 (0.5–1)
	range	0.25–750
Rybelsus dosage (oral)	mean (SD)	10.33 (4.49)
	median (Q1–Q3)	14 (7–14)
	range	1–14
Saxenda dosage (subcut.)	mean (SD)	1.78 (0.79)
	median (Q1–Q3)	1.8 (1.2–2.4)
	range	0.6–3
Victoza dosage (subcut.)	mean (SD)	5 (6.07)
	median (Q1–Q3)	1.8 (1.5–6.9)
	range	1.2–12
Duration of drug use	up to 2 months	16.5% (n = 55)
	3–6 months	35.9% (n = 120)
	7 months–1 year	32.6% (n = 109)
	over 1 year	15% (n = 50)
Reason for taking the drug	insulin resistance	49.6% (n = 168)
	obesity/overweight	62.8% (n = 213)
	diabetes or prediabetes	29.2% (n = 99)
	other	3.8% (n = 13)

SD – standard deviation; Q1–Q3 – first–third quartiles

Hygiene habits

In terms of daily oral hygiene, 65.8% of respondents reported brushing their teeth twice per day, whereas 17.1% did so only once per day. Approximately 12% brushed more than twice per day, and 5.1% admitted to brushing less frequently than once a day. Regarding interdental hygiene, 64.6% declared using dental floss or interdental brushes at least once a day or several times per week. However, 35.4% either rarely used interdental cleaning aids or did not use them at all.

Smoking habits were reported by 10.7% of participants, and 89.3% were non-smokers. In total, 8% of the respondents used removable dentures, and half of them (4% of the total sample) noticed increased oral mucosal irritation when both dentures and GLP-1 agonists were used concurrently.

Overall, these preliminary findings suggest that while most participants adhered to basic oral hygiene recommendations, a substantial minority failed to clean interdental spaces regularly. Such suboptimal hygiene practices, combined with the occurrence of adverse effects like dry mouth, might predispose some individuals to gingival or mucosal complications – particularly in the context of diabetes, insulin resistance, or obesity.

Significance levels

Statistical significance was set at $p < 0.05$, with additional indications for $p = 0.01$ and $p = 0.001$. Where $p < 0.001$, the result is explicitly noted as such, and all statistically significant p-values are highlighted in bold in the full data analyses (not shown here). The tests employed included the chi-square test or Fisher's exact test for categorical variables (depending on category sample sizes) and the Mann–Whitney U-test for comparisons of non-normally distributed continuous data.

The next sections (not provided here) address comparisons of oral hygiene parameters, side-effect profiles, and other variables, further elucidating the relationship between GLP-1 analogues and oral health outcomes.

The smallest subgroup of respondents (0.6%) reported brushing their teeth once a day or less often. In contrast, most participants indicated relatively good adherence to basic brushing frequency, with 61.7% stating that they clean interdental spaces using specialized brushes or dental floss. Smoking was reported by 17.4% of the study group, whereas 7.1%

declared having existing gum or periodontal diseases. Removable dentures were used by 7.2% of participants; among these denture wearers, oral mucosa was deemed 1% more susceptible to damage compared with their pre-treatment status. A total of 58.7% reported concurrent use of other medications.

When evaluating associations between individual variables, no statistically significant relationship emerged between oral hygiene and gender. However, analyses by age revealed a statistically significant trend indicating that older respondents were more likely to brush their teeth twice per day (Tab. 2). By contrast, younger individuals (particularly those aged 21–30) were more prone to brushing only once per day.

A similar age-related pattern was noted for interdental hygiene: participants aged 51–60 most frequently reported using interdental brushes, floss, or other adjuncts. Statistical testing of education level (Tab. 3) demonstrated a significant association between the highest educational attainment and the regular use of interdental tools. Specifically, 67.1% of respondents with higher education used floss or interdental brushes, compared with 46.7% among those with primary or secondary education.

Further analyses showed a statistically significant relationship ($p < 0.05$) between having gum or periodontal disease and a heightened occurrence of aphthous ulcers or erosions in the oral cavity (Tab. 4). Conversely, gum swelling did not correlate significantly with any tested hygiene variables. Regarding oral mucosa peeling, no statistically significant relationship emerged between this outcome and tooth brushing, interdental care, smoking, or periodontal disease status.

Similarly, the increased incidence of herpes showed no significant correlation with brushing frequency, interdental cleaning habits, smoking, or periodontal disease. None of the tests indicated a meaningful association between angular cheilitis and those same factors. However, gum pain while using the studied drugs did exhibit a statistically significant link ($p < 0.05$) to gum or periodontal disease: more than 16% of respondents experienced both gum pain and periodontal pathology (Tab. 4). By contrast, self-reported oral dryness did not show any statistically significant relationship with brushing, interdental cleaning, smoking, or periodontal disease presence.

DISCUSSION

The present findings suggest that patients undergoing GLP-1 analogue therapy tend to exhibit suboptimal oral hygiene practices, particularly concerning the cleaning of interdental spaces. Nearly 40% of respondents reported not using dental floss, interdental brushes, or other tools. These observations align with data from Varela-Centelles et al., whose research in Galicia indicated that only a minority of patients regularly maintain meticulous oral hygiene routines [9].

In our study, higher educational attainment was associated with more consistent interdental care, underscoring the influence of health literacy on daily hygiene habits. Moreover,

gum or periodontal disease was significantly correlated with an increased frequency of aphthous ulcers or erosions, as well as gum pain, reflecting a potential bidirectional interaction between systemic factors (such as diabetes or insulin resistance) and the oral environment. These results highlight the importance of regular dental check-ups, targeted patient education, and, where necessary, more intensive professional prophylaxis to mitigate the risk of periodontal complications in individuals treated with GLP-1 analogues.

Further research with a longitudinal design and larger cohorts may help clarify causal pathways, determine best practices for preventive interventions, and assess whether particular GLP-1 formulations confer a greater risk for oral complications.

Despite some improvements in interdental hygiene practices, overall oral hygiene levels among patients remain suboptimal [9]. Our study indicates that approx. 70% of participants brush their teeth twice a day. However, further patient education is needed, especially regarding gum disease prevention, which can be fostered through targeted educational sessions [12]. Our findings also highlight that various factors, particularly educational level, influence oral hygiene habits [13]. Specifically, a significantly higher percentage of individuals with higher education reported cleaning interdental spaces than those with primary or secondary education (67.07% vs. 46.67%). These results echo a study conducted among alcohol-dependent patients at the Medical University of Wroclaw, which showed a correlation between education level and the use of additional oral hygiene measures [14]. Peršić Bukmir et al. likewise concluded that socio-economic status significantly impacts the adoption of – and adherence to – various hygiene tools [15].

Regarding age, our data reveal an upward trend in brushing frequency and the use of adjunctive hygiene accessories among older individuals. However, contrasting evidence has been presented by Greene, who observed that oral hygiene deteriorates with advancing age, based on standardized indices (OHI, PI, DI-S, CI-S) [16]. Müller et al. similarly reported diminished periodontal health among the elderly, possibly due to reduced manual dexterity or vision [17]. The higher prevalence of loneliness and depression in older populations may also contribute to inadequate oral care. Encouragingly, Reisine et al. demonstrated that social and individualized interventions in nursing home settings could measurably improve gingival indices and plaque scores, emphasizing the need for motivation and a personalized approach [18]. Although we observed no statistically significant association between gender and oral hygiene, Lipsky et al. noted a tendency for men to practice poorer hygiene, suggesting the need for further study [19].

Some participants who reported pronounced mucosal exfoliation may be particularly vulnerable to oral lesions such as aphthae or erosions, which our survey found to be significantly more frequent in the presence of gingival or periodontal diseases. Periodontal pathologies primarily arise from bacterial biofilm accumulating along the interface between hard tooth

surfaces and soft tissues [20]. When coupled with diabetes, inadequate oral hygiene can launch a cascade beginning with caries and gingivitis and culminating in tooth loss and systemic complications [21]. Tooth loss also lowers occlusal height, potentially altering facial features and provoking lip corner drooping that can foster angular cheilitis [22], frequently aggravated by superinfections (e.g., *Staphylococcus aureus*, *Candida*, *Streptococci*) [23]. Indeed, the risk of periodontitis is 2–3 times higher among patients with type 2 diabetes, reflecting a bidirectional relationship [24]. Optimal management thus requires thorough medical histories, comprehensive examinations, and a holistic treatment paradigm [25, 26]. Moreover, antidiabetic medications – including the GLP-1 analogues studied here – help regulate glycemia, curbing the progression of periodontitis and related complications.

Inflammation per se was not found to be a statistically significant adverse effect of the studied drugs. Nonetheless, our results hint at a possible decline in angular cheilitis incidence, although this decrease was not statistically robust. Another important issue is xerostomia, a multifactorial condition that can worsen with age [27], occur secondary to autoimmune disorders such as Sjögren's syndrome [28], or emerge as a drug side effect [29]. Because GLP-1 analogues are primarily used by patients with type 2 diabetes, and oral dryness is a known symptom of hyperglycemia [30], it may be relatively common in this population – particularly when glycemic control is suboptimal.

It should be noted that participants completed the questionnaire autonomously, without supervision from dental professionals. Although responses were subjective, the survey was fully anonymous and voluntary, leaving little reason to suspect systematically inaccurate reporting. Overall, the findings represent a snapshot of patient-perceived oral health and hygiene practices, which, though generally acceptable, underscore the need for more frequent dental check-ups and intensified hygiene counseling in individuals treated with GLP-1 analogues.

Clinical relevance

Because diabetes is multifactorial, it increases the risk of periodontal disease, and proper oral hygiene remains critical for prevention. Our results suggest that many patients do not fully appreciate the importance of oral hygiene in mitigating periodontal issues, particularly in the context of diabetes. This gap underscores the necessity of an interdisciplinary approach involving both dental and medical practitioners. Diabetologists, for instance, should emphasize the heightened periodontal risk in patients with diabetes or insulin resistance, while dentists should provide regular scaling and root debridement to avert further periodontal damage.

TABLE 2. Comparison of variables regarding patients' hygiene habits in relation to the variable: age

Variable	Parameter	21–30 (n = 39)	31–40 (n = 115)	41–50 (n = 137)	51–60 (n = 39)	Test	p-value
How many times a day do you brush your teeth?	less than once a day	0% (n = 0)	0.9% (n = 1)	0.7% (n = 1)	0% (n = 0)	Fisher	0.0012
	once a day	35.9% (n = 14)	19.1% (n = 22)	13.9% (n = 19)	0% (n = 0)		
	twice a day	59.0% (n = 23)	61.7% (n = 71)	67.2% (n = 92)	79.5% (n = 31)		
	more than twice a day	5.1% (n = 2)	18.3% (n = 21)	18.2% (n = 25)	20.5% (n = 8)		
Do you use interdental brushes/dental floss/other tools to clean interdental spaces?	yes	46.2% (n = 18)	60.9% (n = 70)	61.3% (n = 84)	87.2% (n = 34)	Fisher	0.0012
	no	53.8% (n = 21)	39.1% (n = 45)	38.7% (n = 53)	12.8% (n = 5)		
Do you smoke?	yes	25.6% (n = 10)	17.4% (n = 20)	13.9% (n = 19)	25.6% (n = 10)	χ^2	0.1935
	no	74.4% (n = 29)	82.6% (n = 95)	86.1% (n = 118)	74.4% (n = 29)		
Do you suffer from gum/periodontal disease?	yes	5.1% (n = 2)	9.6% (n = 11)	3.6% (n = 5)	15.4% (n = 6)	Fisher	0.0751
	no	79.5% (n = 31)	81.7% (n = 94)	89.8% (n = 123)	74.4% (n = 29)		
	I do not know	15.4% (n = 6)	8.7% (n = 10)	6.6% (n = 9)	10.3% (n = 4)		

TABLE 3. Comparison of variables regarding patients' hygiene habits in relation to the variable: education

Variable	Parameter	Primary or secondary (n = 90)	Higher (n = 249)	Test	p-value
How many times a day do you brush your teeth?	less than once a day	1.1% (n = 1)	0.4% (n = 1)	Fisher	0.4273
	once a day	21.1% (n = 19)	15.7% (n = 39)		
	twice a day	63.3% (n = 57)	66.7% (n = 166)		
	more than twice a day	14.4% (n = 13)	17.3% (n = 43)		
Do you use interdental brushes/ dental floss/other tools to clean interdental spaces?	yes	46.7% (n = 42)	67.1% (n = 167)	χ^2	0.001
	no	53.3% (n = 48)	32.9% (n = 82)		
Do you smoke?	yes	22.2% (n = 20)	15.7% (n = 39)	χ^2	0.2133
	no	77.8% (n = 70)	84.3% (n = 210)		
Do you suffer from gum/periodontal disease?	yes	7.8% (n = 7)	6.8% (n = 17)	χ^2	0.1486
	no	77.8% (n = 70)	85.5% (n = 213)		
	I do not know	14.4% (n = 13)	7.6% (n = 19)		

TABLE 4. Comparison of variables regarding patients' hygiene habits in relation to the variable: Have you noticed an increased occurrence of aphthas/ erosions in the oral cavity while using the drug?

Variable	Parameter	Yes (n = 30)	No (n = 309)	Test	p-value
How many times a day do you brush your teeth?	less than once a day	3.3% (n = 1)	0.3% (n = 1)	Fisher	0.1811
	once a day	23.3% (n = 7)	16.5% (n = 51)		
	twice a day	60.0% (n = 18)	66.3% (n = 205)		
	more than twice a day	13.3% (n = 4)	16.8% (n = 52)		
Do you use interdental brushes/ dental floss/other tools to clean interdental spaces?	yes	66.7% (n = 20)	61.2% (n = 189)	χ^2	0.6928
	no	33.3% (n = 10)	38.8% (n = 120)		
Do you smoke?	yes	20.0% (n = 6)	17.2% (n = 53)	χ^2	0.8882
	no	80.0% (n = 24)	82.8% (n = 256)		
Do you suffer from gum/periodontal disease?	yes	16.7% (n = 5)	6.1% (n = 19)	Fisher	0.023
	no	66.7% (n = 20)	85.1% (n = 263)		
	I do not know	16.7% (n = 5)	8.7% (n = 27)		

CONCLUSIONS

1. Brushing frequency and interdental care – most patients reported brushing twice daily and employing additional interdental aids. These practices are not gender-dependent and generally increase with advancing age and higher educational attainment.

2. Gingivitis/periodontitis and aphthae – patients noted more frequent aphthous lesions when gingivitis or periodontitis was present compared with pre-GLP-1 therapy. By contrast, no increase was observed for herpes, angular cheilitis, or xerostomia.

3. Gum pain – articipants did report gum pain associated with GLP-1 analogue use, suggesting the importance of regular periodontal assessment and early intervention.

Overall, these results point to the need for enhanced oral health education and preventive strategies among GLP-1 recipients, aiming to reduce periodontal complications in at-risk populations.

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