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Association between oral hygiene product usage and perceived oral health: An empirical study on middle-aged and older adults in the UK

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Abstract
Oral health remains a critical public health concern, particularly among middle-aged and older adults, where disparities in oral hygiene practices persist. This study investigates the relationship between oral hygiene product usage and perceived oral health status among UK adults aged 50 and above. A structured survey was conducted with 414 participants, analysing oral hygiene behaviours, awareness, and subjective oral health perceptions. Statistical analyses, including logistic regression and factor analysis, revealed that while toothbrush usage was widespread, interdental brushes and dental floss were underutilized, especially among males and individuals with lower educational attainment. Notably, the frequent use of dental floss and interdental brushes was significantly associated with positive oral health perceptions, whereas smoking and recent dental treatments correlated with more negative assessments. These findings underscore the necessity of targeted oral health education programs promoting comprehensive hygiene practices beyond toothbrushing. Public health initiatives should focus on increasing awareness and accessibility of effective oral care strategies to improve long- term oral health outcomes in aging populations.

Keywords: Use of oral hygiene products, perceived oral health status, oral health behaviour, study on middle- aged and older adults, UK-based study

1. Introduction
Globally, oral health has not improved as significantly as other medical fields, and with the rapidly aging population, there is increasing interest in preventing oral diseases and maintaining oral hygiene.

Oral diseases constitute a major public health issue worldwide, and in many cases, the cost of treating these conditions places a significant burden on both individuals and healthcare systems, becoming a substantial societal concern (Jevdjevic & Listl, 2019) [20]. In particular, as the prevalence of tooth loss declines, the relative burden of severe periodontal disease is increasing, which is not confined to a single nation but represents a global issue (WHO, 2021). Since the 1960s, it has been recognized that socioeconomic factors such as education level and income are associated with disparities in the prevalence and severity of periodontal disease. Furthermore, an individual's living environment and lifestyle patterns have been consistently linked to the prevalence and severity of oral diseases, as demonstrated in various studies (Kinane & Marshall, 2001 [24]; Eke *et al*., 2012) [10].

Dental caries and periodontal disease are among the most prevalent oral diseases, primarily caused by bacterial dental biofilm that accumulates between teeth, commonly referred to as dental plaque. This plaque cannot be removed through the natural self-cleansing mechanisms of the oral cavity; instead, it requires mechanical removal using oral hygiene products such as toothbrushes. Effective plaque removal for the prevention of oral diseases can be categorized into mechanical plaque control and chemical plaque control methods. Mechanical plaque control involves the use of oral hygiene tools such as toothbrushes, interdental brushes, dental floss, tongue scrapers, water flossers, rubber interdental stimulators, and gum massagers to physically eliminate plaque. Chemical plaque control, on the other hand, employs chemical

agents such as oral rinses and antimicrobial solutions to assist in plaque removal and is generally used as an adjunct to mechanical methods (Figuero et al., 2017; Li et al., 2024; Hart et al., 2024).

Numerous studies have been conducted from various perspectives to advocate the use of oral hygiene products and emphasize the importance of continuous oral hygiene management. These studies have investigated both the usage patterns of oral hygiene products and their effectiveness in removing dental plaque (Jafer et al., 2016; Jiao, 2019; Vyas et al., 2021). Despite this extensive research, the utilization rate of oral hygiene products among adults in the UK remains relatively low (DHSC, 2021). This trend is particularly pronounced among individuals aged 50 and older, where the usage rate is even lower (Davies & Doshi, 2022; Lipsky et al., 2024). Notably, within this age group, oral hygiene products other than toothbrushes—such as interdental brushes and dental floss—are not regularly used. Consequently, there remains a significant research gap regarding the relationship between the use of oral hygiene products, individuals' perception of their periodontal health, and their actual periodontal health status.

This study distinguishes itself by expanding upon previous research that explored the relationship between the use of oral hygiene products and perceived oral health, focusing specifically on empirical analysis of middle-aged and older adults aged 50 and above. While prior studies have primarily examined oral hygiene practices among adolescents and young adults (Folayan *et al*., 2020 [12]; Inquimbert *et al*., 2022 [17]; Zhang *et al*., 2023) [51] or the effectiveness of therapeutic interventions for specific oral diseases such as periodontitis and dental caries (Jepsen *et al*., 2017 [19]; Al-Nasser & Lamster, 2020 [1]; Nguyen *et al*., 2022) [33], this research provides a comprehensive empirical investigation into the oral hygiene behaviours and perceptions of middle-aged and older adults in the UK. In particular, this study not only examines the use of oral hygiene products but also evaluates awareness of proper usage, smoking habits, denture use, and socioeconomic factors to provide a more holistic understanding of their impact on both subjective oral health perceptions and actual dental treatment status. The findings of this study can serve as a foundation for the development of tailored oral hygiene education programs for older adults and contribute to the formulation of public health policies aimed at improving oral health outcomes in this demographic. Ultimately, the objective of this research is to encourage individuals aged 50 and older to adopt more proactive oral hygiene practices, leading to improved oral disease prevention and sustained oral health management following treatment.

Study Population and Methods

Study Population

This study employed a random sampling method, targeting residents aged 50 and above in Reading, UK, over a seven-month period from July 2024 to February 2025. Data collection was conducted through self-administered structured questionnaires, which were distributed to patients visiting general practitioners (GPs1). Of the 427 responses collected, 13 responses were excluded due to low response accuracy, leaving a final sample of 414 participants for analysis. The survey included items assessing participants' general demographic characteristics, the use and types of oral hygiene products, awareness of proper usage, perceived oral health status, and actual dental disease conditions (dental treatments in the previous quarter).

To ensure a comprehensive and objective analysis, sociodemographic and health behaviour variables were included as potential confounding factors. The sociodemographic variables considered in this study included gender, age, weight, and educational attainment. Age was categorized into four groups: 50-59, 60-69, 70-79, and 80 years or older. Education level was classified as Primary school or below, Secondary school, University (including college), and Post-Graduate level. The health behaviour variables incorporated into the analysis included smoking status, denture and implant use, frequency of oral hygiene product use, and the number of dental treatments received in the past quarter. Smoking status was further classified into non-smoker, former smoker (quit smoking more than 10 years ago), recent quitter (quit smoking within the last 5 years), and current smoker. Denture use was categorized into no dentures, partial dentures, complete dentures, and implant-supported dentures.

Research Methods and Statistical Analysis

The collected data were analysed using SPSS (version 12.0). Various factors, including the frequency of oral hygiene product usage, awareness of proper usage, perceived effectiveness, and subjective oral health status, were measured using a 5-point Likert scale. To ensure consistency in interpretation, reverse coding was applied, so that higher scores indicated more positive responses. Additionally, Cronbach's Alpha analysis was conducted to assess the reliability of the survey items. The analysis revealed that all constructs had Cronbach's Alpha values above 0.7, confirming high internal consistency among the items used in the study. In general, a Cronbach's Alpha value of 0.7 or higher is considered an indicator of acceptable reliability (Nunnally & Bernstein, 1994) [34], suggesting that the measured constructs in this study were statistically valid and appropriate for analysis.

Following this, a complex sample multivariate logistic regression analysis was conducted to examine how sociodemographic characteristics and oral hygiene product usage behaviours influenced the prevalence of oral diseases. To ensure the suitability of the logistic regression model, Bartlett's Test of 1 GP stands for General Practitioner or family doctor. It refers to a primary care physician who provides general medical services without specializing in a specific field. GPs are responsible for diagnosing and treating a wide range of illnesses and health conditions. They play a crucial role in primary healthcare, especially in countries like the UK and Australia.

Sphericity and the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy were performed. Bartlett's Test was used to confirm that the variables exhibited sufficient correlation for factor analysis, while the KMO Measure assessed sampling adequacy. The results of these tests validated the reliability and appropriateness of the factor analysis in this study.

Table 1: Results of Bartlett's test and KMO measure

Test	Value	p-value	Interpretation
Bartlett's Test of Sphericity	250.32	< 0.001	Significant (Regression analysis appropriate)
Kaiser-Meyer-Olkin (KMO) Measure	0.765	N/A	Adequate (Sampling is suitable for factor analysis)

As shown in Table 1, the chi-square (χ^2) value of Bartlett's Test was 250.32, with a p-value of < 0.001, confirming that there was sufficient correlation among the variables to justify conducting a factor analysis. Additionally, the Kaiser-Meyer-Olkin (KMO) measure was 0.765, indicating that the dataset met the criteria for a suitable factor analysis (Kaiser, 1974) [22]. These results suggest that the variables in the study were sufficiently correlated and that the factor analysis was likely to yield reliable findings. Therefore, the Principal Component Analysis (PCA) and factor analysis conducted in this study were derived based on statistically sound evidence.

All models included confounding variables to ensure robust analysis. In Table 5, Model 1 was constructed using sociodemographic variables (age, gender, weight, education level) and health behaviour variables (smoking status, denture use). Model 2 incorporated oral hygiene product usage and frequency as additional explanatory variables. Statistical significance was set at $P<0.05$, and the analysis was conducted as follows:

- Descriptive statistics (frequencies and percentages) were examined to understand the general characteristics of the study participants.
- Mean difference tests (t-tests and ANOVA/F-tests) were performed to assess variations in oral hygiene product usage and awareness of proper usage.
- Correlation analysis and regression analysis were conducted to investigate the relationship between oral hygiene product usage, its perceived effectiveness, and subjective oral health status.

Statistical Analysis Results

General Characteristics of the Study Population

An analysis of the general characteristics of the study participants revealed that 44.2% (n = 183) were male, while 55.8% (n = 231) were female, indicating a higher proportion of female respondents. As shown in Table 2, the largest age group was 60-69 years, comprising 54.6% of the sample, followed by the 70-79 age group, which accounted for 23.3%. Furthermore, 50.3% of the participants had received dental treatment for periodontal disease or other oral health conditions in the previous quarter. A trend was observed in which the occurrence of dental treatment was positively associated with weight increase and inversely related to educational level. However, this pattern was merely a trend and did not indicate a statistically significant relationship.

Table 2: General Characteristics of the Study Population

Characteristics	Division	N	%
All		414	100.0
Sex	Male	183	44.2
	Female	231	55.8
Age	≥ 80	41	9.7
Education Level	≥ Post-graduate	52	12.6
Score	≥ 90	115	27.8
Smoking Status	Current smoker	83	20.0
Prosthesis	Implant-supported dentures	84	22.6
Dental Treatment (Last Quarter)	≤ 1 visit	206	49.7
	2-5 visits	122	29.5
	6-9 visits	61	14.7
	≥ 10 visits	25	6.1

An analysis of the participants' smoking behaviour revealed that 45.7% of respondents had never smoked, accounting for nearly half of the sample. When including those who had quit smoking for more than 10 years (28.7%), the proportion of non-smokers and long-term quitters combined reached 74.4%, indicating a notably high rate. This finding is likely attributable to the fact that all study participants were 50 years or older, a demographic where health concerns and the increased awareness of smoking-related diseases contribute to a higher likelihood of abstaining from smoking. Regarding denture use, the proportion of respondents with no dentures was relatively high at 34.8%. However, this figure also includes individuals who had undergone tooth extractions without opting for implants, which may have inflated the percentage. In contrast, the proportion of respondents with implant-supported dentures was 22.6%, which was relatively low compared to other denture types.

Usage of Oral Hygiene Products

The frequency of oral hygiene product usage was measured using a 5-point Likert scale, where 1 = Never Used, 2 = Used a Few Times, 3 = Occasionally Used, 4 = Regularly Used, and 5 = Used Daily. The results indicate that more than half of the participants used at least two types of oral hygiene products in addition to a toothbrush. As shown in Table 3, females (mean score = 3.54) exhibited a higher frequency of oral hygiene product usage compared to males (mean score = 3.42). This finding aligns with previous studies that have reported gender differences in oral hygiene behaviours (Martin *et al*., 2021 [30]; Su *et al*., 2022). The only exception was oral rinse usage, where males (mean = 5.25) reported a slightly higher frequency than females by 0.03 points, though this difference was not statistically significant.

Table 3: Usage of Oral Hygiene Products

Characteristics	Overall	Tooth-brush	Dental floss	Interdental brush	Oral rinse	Tongue scraper	Water flosser
Sex							
Male	3.42	4.72	3.38	3.26	3.52	3.07	2.55
Female	3.54	4.86	3.72	3.57	3.49	2.88	2.27
t	1. 556	- 0.893	- 2.280	- 2.436*	- 1.116	0.292	1.638
Age (yrs)							
50- 60	3.63	4.88	3.67	3.52	3.35	3.42	3.26
60-69	3.59	4.91	3.51	3.36	3.71	3.16	2.79
70-79	3.30	4.78	3.20	2.74	3.83	2.93	2.44
≥ 80	3.13	4.71	2.84	2.38	3.66	2.85	2.26
F	3.63 3*	1.330	0.893	4.145**	0.525	2.720*	1.472
Education							
≤ Primary school	3.51	4.82	3.44	3.39	3.47	3.28	2.52
Secondary school	3.48	4.67	3.36	3.51	3.42	3.40	2.66
Uni or College	3.61	4.88	3.65	3.45	3.67	3.47	2.84
≥ Post-Graduate	3.65	4.79	3.74	3.56	3.65	3.44	2.91
F	2.427	1.181	2.404	1.497	1.167	4.269**	2.105
Weight (kg)							
≤ 69	3.59	4.85	3.52	3.36	3.49	3.18	3.06
70-79	3.45	4.77	3.37	3.30	3.52	3.03	2.89
80-89	3.32	4.72	3.39	3.18	3.33	2.77	2.32
≥ 90	3.09	4.66	3.24	2.97	3.05	2.81	1.94
F	2. 932	1.970*	0.405	6.181**	0.697	2.537	3.648*
Smoking							
Non-smoker	3.20	4.76	3.42	3.17	3.26	2.86	1.96
Recent quitter#	3.58	4.85	3.66	3.52	3.66	3.35	2.21
Ex-smoker##	3.16	4.63	3.53	2.83	3.41	2.92	1.83
Current smoker	3.52	4.81	3.57	3.62	3.62	3.09	2.32
F	2.71 5	0.309	5.218*	2.729	0.773	1.458	2.11 5
Dentures							
No Dentures	3.56	4.76	3.37	3.45	3.51	3.30	2.57
Partial Dentures	3.69	4.79	3.15	2.88	3.68	3.29	2.74
Complete Dentures	3.21	4.63	-	-	3.28	3.11	1.98
Implant Dentures	3.76	4.83	4.08	3.35	3.70	3.34	2.96
F	3. 180	1.663	2.409	4.821**	0.660	2.218	0.703
Dental treatment							
≤ 1	3.50	4.84	3.33	3.72	3.48	3.23	2.39
2-5	3.48	4.75	3.47	3.50	3.28	2.86	2.22
6-9	3.33	4.67	3.81	3.26	3.51	2.77	2.47
≥ 10	3.49	4.92	3.60	3.39	3.70	2.95	2.58
F	2. 885	1.297	4.022 **	3.823**	1.335	0. 828	0.579

$p \leq 0.05$ → Statistically significant ** $p<0.01$ → Highly statistically significant # Within 5 years of quitting smoking ## More than 10 years since quitting smoking

Among all oral hygiene products, toothbrush was the most frequently used across all study participant's groups, followed by dental floss, oral rinse, interdental brush, tongue scraper, and water flosser. Notably, the use of water flosser was minimal, with an average usage score of 2.69, suggesting that water flosser may be perceived more as a therapeutic device rather than a regular oral hygiene tool (Sabbahi *et al*., 2021) [37]. Regarding dental floss usage, females (mean = 3.72) reported a significantly higher frequency compared to males, aligning with previous studies that have identified gender differences in flossing habits (Borrell & Papapanou, 2005) [4]. Since all study participants were aged 50 and above, no significant differences were observed in oral hygiene product usage based on age. Similarly, education level did not appear to influence usage patterns. However, body weight was found to be significantly associated with oral hygiene product usage, with a decline in usage frequency observed as body weight increased. This trend is consistent with prior research examining the relationship between obesity and oral health behaviours (Valenzuela *et al*., 2021) [43].

A notable pattern was observed in relation to smoking status. While education level and body weight generally exhibited gradual variations in oral hygiene product usage, smoking status showed an irregular pattern. Specifically, current smokers (mean = 3.52) reported higher usage than ex-smokers (mean = 3.16), who had quit smoking more than 10 years ago. Interestingly, recent quitters (mean = 3.58) showed an increase in usage frequency, while non-smokers (mean = 3.20) exhibited a decline. This suggests that long-term ex-smokers and non-smokers may be less concerned about oral health compared to current smokers and recent quitters, which is consistent with previous research indicating that smokers tend to have a heightened awareness of their periodontal disease risk compared to non- smokers (Beklen *et al*., 2022 [3]; Mišković *et al*., 2024) [31]. When analysing oral hygiene product usage by denture status, individuals with implant-supported dentures (mean = 3.76) had the highest usage frequency, whereas those with complete dentures (mean = 3.21) had the lowest. This suggests that complete denture wearers may have a lower awareness or perception of the need for general oral hygiene maintenance beyond denture cleaning. Notably, complete denture users demonstrated lower engagement in oral hygiene practices compared to both partial denture users and individuals with no dentures, further

indicating a potential gap in oral hygiene education and awareness among this group.

Awareness of Proper Oral Hygiene Product Usage

The degree of awareness regarding the proper use of oral hygiene products was measured using a 5- point Likert scale, where 1 = No knowledge, 2 = Minimal knowledge, 3 = Basic knowledge, 4 = Well- informed, and 5 = Expert-level knowledge. As shown in Table 4, participants demonstrated higher awareness of frequently used oral hygiene products such as toothbrushes and dental floss, as well as oral rinses, which are relatively simple to use. In contrast, awareness of the usage of interdental brushes and water flossers was relatively lower. However, it is important to note that this awareness score is based on self-assessment, which may not necessarily reflect actual proficiency in using these products correctly. Regardless of age, education level, or smoking status, toothbrush usage knowledge was reported as the highest across all groups. However, despite its overwhelmingly high usage frequency (in Table 2, mean = 4.64), the awareness of proper toothbrush usage was not as absolute as its usage rate suggests. Participants reported moderate awareness levels for dental floss (mean = 4.05) and oral rinse (mean = 4.13). Specifically, a statistically significant gender difference ($p \leq 0.05$) was observed in the awareness of proper oral rinse usage, indicating that male and female participants differed in their understanding of how to correctly use oral rinses.

Table 4: Awareness of Proper Oral Hygiene Product Usage

Characteristics	Overall	Tooth-brush	Dental floss	Interdental brush	Oral rinse	Tongue scraper	Water flosser
Sex							
Male	3.38	4.63	4.26	3.58	4.05	3.23	2.85
Female	3.46	4.68	3.92	3.72	4.32	3.02	2.37
t	1.1 27	1.829	- 1.6 32	- 1.882	2.268*	0.772	0.247
Age (yrs)							
50-59	3.52	4.56	3.97	3.66	3.98	2.95	2.66
60-69	3.77	4.61	4.21	3.57	4.25	3.27	2.30
70-79	3.83	4.75	4.08	3.82	4.43	3.19	2.91
≥ 80	3.71	4.63	4.15	3.78	3.38	3.30	2.78
F	1.524	2.076	4.195**	3.279	0.838	1.518	1.336
Education							
≤ Primary school	3.70	4.61	3.86	3.63	4.33	2.97	2.46
Secondary school	3.66	4.53	4.21	3.54	3.98	3.33	2.69
Uni or College	3.79	4.66	4.02	3.69	4.44	3.21	2.85
≥ Post-Graduate	3.92	4.82	4.33	3.86	4.25	3.16	2.93
F	2.883	0.952	1.369	3.740	1.607	4.829	0.443
Weight (kg)							
≤ 69	4.03	4.83	4.44	3.78	4.46	3.20	3.01
70-79	3.76	4.79	4.35	3.38	4.35	3.23	2.79
80-89	3.66	4.62	3.86	3.59	4.32	2.99	2.43
≥ 90	3.59	4.45	4.12	3.32	3.97	2.92	2.48
F	2.451	1.515	3.909	2.881	5.386 *	0.528	0.772
Smoking							
Non-smoker	3.84	4.73	4.15	3.65	4.18	3.41	2.63
Recent quitter#	3.67	4.80	3.87	3.82	3.96	3.00	2.88
Ex-smoker##	3.62	4.66	4.29	2.33	4.44	3.15	2.56
Current smoker	3.87	4.56	4.44	3.74	4.53	3.22	2.90
F	1.663	3.493*	3.715	0.556	0.347	1.233	4.277
Dentures							
No Dentures	3.92	4.82	4.33	3.55	4.54	3.57	2.39
Partial Dentures	3.80	4.80	4.15	4.21	4.18	3.08	2.62
Complete Dentures	3.75	4.59	3.97	3.99	4.02	3.44	2.77
Implant Dentures	3.93	4.63	4.40	3.66	4.40	3.14	2.91
F	3.270	1.330	5.934**	2.141**	0.304	1.108	0.811
Dental treatment							
≤ 1	3.68	4.65	3.96	3.55	4.05	3.14	2.54
2-5	3.51	4.63	3.88	3.43	3.99	3.08	2.29
6-9	3.72	4.52	4.04	3.73	4.12	2.89	2.52
≥ 10	3.97	4.84	4.36	3.94	4.36	3.41	2.78
F	2.916	3.343	2.190	0. 224	1.616	2.221	0.880

$p \leq 0.05$ → Statistically significant ** $p < 0.01$ → Highly statistically significant # Within 5 years of quitting smoking ## More than 10 years since quitting smoking

When analysing awareness of proper usage across different characteristics, females demonstrated slightly higher awareness scores than males (by 0.08 points). However, this difference was not statistically significant. No substantial differences were observed in awareness levels based on age or education level, suggesting that sociodemographic factors had minimal influence on participants' understanding of proper oral hygiene product usage. In contrast, health behaviour factors such as body weight and smoking status exhibited more noticeable differences in awareness levels. Across all oral hygiene products, awareness of proper usage was generally higher than actual usage frequency (as seen in Table 3). Notably, participants with dentures demonstrated the highest awareness levels overall, particularly for dental floss

and interdental brushes, where a highly significant statistical difference was observed ($p<0.01$). Additionally, participants who had undergone dental treatment 10 or more times in the previous quarter exhibited a marked increase in their awareness of proper oral hygiene product usage. This finding suggests that individuals tend to initially use oral hygiene products based on personal preference and perceived need rather than proper technique. However, as oral health issues arise, they gradually become more knowledgeable about the correct usage of these products (Tadin & Badrov, 2023) [42].

Analysis of the Relationship between Oral Hygiene Product Usage and Its Effectiveness

This study conducted correlation and regression analyses to examine the impact of oral hygiene product usage on perceived oral hygiene effectiveness, as presented in Table 5. The results demonstrated a statistically significant positive relationship between the use of toothbrushes (r = 0.214, $p<0.05$), dental floss (r = 0.356, $p<0.001$), interdental brush (r = 0.307, $p<0.01$), and oral rinse (r = 0.180, $p<0.05$) with perceived oral hygiene effectiveness. These findings align with previous research, which has highlighted the critical role of dental floss and interdental brush in plaque removal and periodontal health maintenance (Slot *et al*., 2008 [39]; Worthington *et al*., 2019) [46]. The results further suggest that individuals who use these oral hygiene products more frequently tend to perceive greater benefits in maintaining oral hygiene and preventing oral health issues.

Table 5: Correlation and regression analysis on the effectiveness of oral hygiene products after usage

Variables	Characteristics	r	M1 (β)	M2 (β)
Usage of oral hygiene variables				
	Toothbrush	0.214*	0.121	0.133
	Dental floss	0.356***	0.320*	0.358**
	Interdental brush	0.307**	0.286**	0.303**
	Oral rinse	0.180	0.082	0.116*
	Tongue scraper	0.198	0.036	0.072
	Water flosser	0.093	0.015	0.030
Other factors	Dental treatment	0.523**	—	0.429
Model Statistics	R^2	—	0.304	0.366
	N	414	414	414

$p \leq 0.05$ → Statistically significant ** $p<0.01$ → Highly statistically significant *** $p<0.001$ → Very highly statistically significant

To identify the factors influencing perceived oral hygiene effectiveness, multiple regression analysis was conducted. In Model 1 (M1), the use of dental floss (β = 0.320, $p<0.05$) and interdental brush (β = 0.286, $p<0.01$) was found to have a statistically significant positive impact on perceptions of oral hygiene effectiveness. These findings are consistent with previous research indicating that interdental cleaning aids contribute to the prevention of periodontal disease (Konstantopoulou & Kossioni, 2023) [25]. In particular, dental floss has been shown to be effective in reducing plaque and preventing periodontal disease, aligning with studies that suggest regular flossing plays a crucial role in maintaining microbial balance within the oral cavity (Amarasena, 2019 [2]; Kim *et al*., 2021) [23]. In Model 2 (M2), the use of dental floss (β = 0.358, $p<0.01$) and interdental brush (β = 0.303, $p<0.01$) remained statistically significant, further reinforcing their role in plaque control and periodontal disease prevention. These results suggest that dental floss and interdental brush are essential tools for maintaining oral hygiene, particularly when used regularly, as they contribute to reducing plaque index scores and supporting overall oral health maintenance (Durand *et al*., 2019 [8]; Gavriilidou & Belibasakis, 2019) [14].

The analysis of the influence of sociodemographic variables revealed that gender, age, and educational level do not have a significant impact. This finding contrasts with previous research (Eke *et al*., 2012) [10], which generally suggests a strong association between oral health behaviours and socioeconomic factors. This discrepancy may be attributed to the characteristics of the study sample, which consisted of relatively homogeneous adults aged 50 and above. However, the use of dentures (β = 0.325, $p<0.01$) demonstrated a significant relationship with perceived oral hygiene effectiveness. This result can be interpreted as individuals who use dentures being more aware of oral hygiene management or requiring more rigorous hygiene practices. In contrast, smoking status (β = -0.257) exhibited a negative association with perceived oral hygiene effectiveness, indicating that smokers tend to perceive their oral hygiene effectiveness lower than non-smokers. This finding aligns with previous research (Patel *et al*., 2012) [36], which established a strong correlation between smoking and periodontal disease, with smokers having a higher prevalence of periodontitis and a more negative self-assessment of their oral health compared to non-smokers.

The coefficient of determination (R^2) of the regression model was found to be 0.304 (30.4%) in Model 1 and increased to 0.366 (36.6%) in Model 2. This suggests that the use of oral hygiene products holds a certain degree of explained variance regarding perceived oral hygiene effectiveness. Notably, the increase in explained variance after incorporating sociodemographic variables in Model 2 indicates the potential influence of these factors on perceptions of oral hygiene effectiveness. In summary, the findings suggest that the use of dental floss and interdental brush plays a crucial role in fostering a positive perception of oral hygiene effectiveness. Additionally, denture use and smoking habits may also contribute to variations in perceived oral hygiene effectiveness.

Association between the Use of Oral Hygiene Products and Perceived Oral Health Status

An analysis of the correlation between the frequency of oral hygiene product use and perceived oral health status revealed a positive relationship, as shown in Table 6. Specifically, the use of toothbrush (r = 0.308), dental floss (r = 0.363, $p<0.05$), interdental brush (r = 0.236), and tongue cleaner (r = 0.198) was positively associated with perceived oral health status. Examining the causal relationships among factors influencing perceived oral health status, multiple regression analysis

demonstrated that in Model 1, dental floss (β = 0.330, $p<0.05$) and interdental brush (β = 0.189, $p<0.05$) had a significant positive impact on self-assessed oral health status. Furthermore, in Model 2, which incorporated sociodemographic variables in addition to oral hygiene product usage, dental floss (β = 0.427, $p<0.001$), toothbrush (β = 0.150), and interdental brush (β = 0.224) remained significant predictors. These findings align with previous research (Marchesan *et al*., 2018; Gallie, 2019 [13]; Ng & Lim, 2019) [32], which suggests that interdental cleaning tools contribute positively to periodontal health. On the other hand, the use of oral rinse (mouthwash) exhibited a negative association with perceived oral health status (r = -0.238). This suggests that individuals who frequently use mouthwash may already have underlying oral health issues or may be using it primarily for symptom relief and oral cleansing rather than for preventive care.

Table 6: Correlation and regression analysis between the usage of oral hygiene products and subjective oral health status

Variables	Characteristics	r	M1 (β)	M2 (β)
Usage of oral hygiene variables				
	Toothbrush	0.308	0.132	0.150
	Dental floss	0.363*	0.330*	0.427***
	Interdental brush	0.236	0.189*	0.224
	Oral rinse	-0.238	0.133	0.158
	Tongue scraper	0.198	-0.088	-0.102
	Water flosser	0.182	0.021	0.028
Other factors	Dental treatment	-0.382	—	-0.372**
Model Statistics	R^2	—	0.292	0.311
	N	414	414	414

$p \leq 0.05$ → Statistically significant ** $p<0.01$ → Highly statistically significant *** $p<0.001$ → Very highly statistically significant

An analysis of the influence of sociodemographic variables revealed that gender, education level, body weight does not exhibit statistically significant effects. However, age (β = -0.493, $p<0.05$), smoking status (β = -0.236), and recent dental treatment experience (β = -0.372, $p<0.01$) demonstrated a negative association with perceived oral health status. In other words, older individuals, smokers, and those with recent dental treatment experiences tended to assess their oral health status more negatively. This finding aligns with previous research (Yu *et al*., 2021; Huang & Dong, 2022 [16]; Chatzopoulos *et al*., 2023) [5], which suggests that periodontal disease is more likely to progress with age and that smoking has a detrimental effect on periodontal health. Additionally, while male participants (β = 0.39) tended to evaluate their oral health status more positively than female participants, this difference was not statistically significant. Overall, individuals who used mechanical cleaning tools such as toothbrush, dental floss, and interdental brush were more likely to perceive their oral health status positively. Conversely, smoking status, age, and recent dental treatment experiences were identified as factors contributing to a more negative perception of oral health.

Findings

In modern society, oral health has become increasingly recognized as an essential component of overall health. However, dental caries and periodontal disease—two of the most prevalent oral diseases and leading causes of tooth extraction—have been on the rise in the UK over the past 30 years (Zemedikun *et al*., 2021 [49]; Elamin & Ansah, 2023) [9]. The primary intraoral environmental factor contributing to the development of these diseases is dental plaque accumulation, which can be effectively managed through individual efforts. As these conditions are largely preventable, plaque control remains a critical aspect of oral health maintenance. Consequently, extensive research has been conducted on the effectiveness of various oral hygiene products in plaque management (Oliveira *et al*., 2021 [35]; Zini *et al*., 2021) [50], with studies indicating that the use of additional oral hygiene aids, alongside regular toothbrushing, enhances plaque removal and improves overall oral cleanliness.

Consistent with previous findings, the present study demonstrates a positive association between the use of oral hygiene products—such as toothbrush, dental floss, and interdental brush—and perceived oral health status. The level of awareness regarding the correct use of dental floss and interdental brush was found to be moderate, whereas knowledge about the proper use of oral irrigators was relatively low. When asked about the perceived effectiveness of oral hygiene products, most respondents reported a moderate level of effectiveness. Further analysis revealed that the use of dental floss (β = 0.427, p <.001) and interdental brush (β = 0.224, p <.005) had a statistically significant impact on self-assessed oral health, aligning with previous research indicating the effectiveness of these tools in reducing plaque and preventing periodontitis (Kim *et al*., 2021) [23]. These findings suggest that individuals may not perceive significant benefits from oral hygiene product use due to improper selection or incorrect usage of products tailored to their specific oral health needs. Consequently, while most respondents reported only a moderate level of effectiveness, those who used a select few oral hygiene products efficiently tended to exhibit a more positive perception of their effectiveness.

Furthermore, smokers assessed their oral health more negatively compared to non-smokers. This finding aligns with previous studies (Leite *et al*., 2018 [26]; Gautam *et al*., 2022), which suggest that smoking increases the risk of periodontal disease and that smokers are more aware of their oral health issues. In contrast, a pattern of increased interest in oral health was observed among individuals who had recently quit smoking, which may reflect their motivation to restore oral health following smoking cessation (Beklen *et al*., 2022) [3]. Regarding denture users, individuals with complete dentures exhibited lower levels of concern for oral hygiene compared to those with partial dentures or natural teeth. This finding is consistent with previous research (Shankar *et al*., 2017 [38]; Szalewski *et al*., 2017) [41], which suggests that some denture wearers tend to limit their oral hygiene practices to denture care alone.

Conclusion

Advancements in medical technology and pharmaceuticals have contributed to the continuous increase in human life expectancy, making oral health among middle-aged and older adults an increasingly important public health concern. Oral health in this population is closely linked to overall quality of life. However, in the United Kingdom, access to NHS dental care remains relatively limited, and among older adults, physical barriers have been identified as key factors contributing to low rates of regular dental visits (Watt *et al*., 2020) [45]. This study aimed to investigate oral hygiene product usage patterns among middle-aged and older adults in the UK and provide baseline data for future initiatives aimed at improving oral health outcomes. A survey was conducted among 414 residents aged 50 and older in UK.

The findings indicate that individuals who use mechanical cleaning tools such as toothbrush, dental floss, and interdental brush tend to assess their subjective oral health status more positively. However, the overall usage rate of oral hygiene products beyond toothbrush remains relatively low, particularly with men and lower education levels. This highlights the need for public health campaigns emphasizing that flossing and interdental cleaning are not merely aspects of routine dental care but essential components of periodontal disease prevention. The analysis of sociodemographic variables revealed that increasing age, smoking status, and recent dental treatment experiences were associated with a more negative perception of subjective oral health. In particular, smokers exhibited a pronounced tendency to rate their oral health more negatively. Additionally, among denture users, those with complete dentures demonstrated lower engagement in oral hygiene management compared to partial denture users or individuals with natural teeth. While NHS-provided dentures are available to older adults in the UK, concerns have been raised about the lack of structured post-placement care and hygiene education. This underscores the need for a more comprehensive and systematic educational program to support proper denture maintenance and overall oral hygiene among older adults.

This study has certain limitations. As the survey sample was restricted to a specific geographic area, the findings may not be fully generalizable to a broader population. Future research should aim to expand the study to a wider and more diverse sample to enhance external validity. Furthermore, this study relied on self-reported subjective assessments of oral health, without incorporating objective clinical dental examination data. Future studies should integrate clinical diagnostic data to establish a more comprehensive and evidence-based understanding of the relationship between oral hygiene product usage and actual oral health status. In conclusion, the findings suggest that preventing oral diseases and improving oral health in older adults requires structured and widespread oral health education programs. Such programs should help individuals recognize the importance of using appropriate oral hygiene products and ensure that they select and use the right tools effectively based on their specific oral health needs.

References

1. Al-Nasser L, Lamster IB. Prevention and management of periodontal diseases and dental caries in the older adults. Periodontology. 2000. 2020;84(1):69-83.
2. Amarasena N, Gnanamanickam ES, Miller J. Effects of interdental cleaning devices in preventing dental caries and periodontal diseases: a scoping review. Australian Dental Journal. 2019;64:327-337. https://doi.org/10.1111/adj.12722
3. Beklen A, Sali N, Yavuz MB. The impact of smoking on periodontal status and dental caries. Tobacco Induced Diseases.2022;20:72. https://doi.org/10.18332/tid/152112
4. Borrell LN, Papapanou PN. Analytical epidemiology of periodontitis. Journal of Clinical Periodontology. 2005;32(6):132-58. https://doi.org/10.1111/j.1600-051X.2005.00803.x
5. Chatzopoulos GS, Jiang Z, Marka N, Wolff LF. Association between periodontitis extent, severity, and progression rate with systemic diseases and smoking: a retrospective study. Journal of Personalized Medicine. 2023;13(5):814.
6. Davies R, Doshi M. Prevention of oral diseases for the older person. In: Doshi M, Geddis-Regan A, editors. Oral health and dental care in the ageing population. BDJ Clinician's Guides. Cham: Springer. 2022. https://doi.org/10.1007/978-3-031-10224-0_5
7. Department of Health & Social Care. Adult dental health survey. 2021. Data.gov.uk. 2021.
8. Durand R, Roufegarinejad A, Chandad F, Rompré PH, Voyer R, Michalowicz BS, *et al*. Dental caries are positively associated with periodontal disease severity. Clinical Oral Investigations. 2019;23(10):3811-9. https://doi.org/10.1007/s00784-019-03019-4
9. Elamin A, Ansah JP. Projecting the burden of dental caries and periodontal diseases among the adult population in the United Kingdom using a multistate population model. Frontiers in Public Health. 2023;11:1190197. https://doi.org/10.3389/fpubh.2023.1190197
10. Eke PI, Dye BA, Wei L, Thornton-Evans GO, Genco RJ. Prevalence of periodontitis in adults in the United States. 2009 and. 2010. Journal of Dental Research. 2012;91(10):914-920. https://doi.org/10.1177/0022034512457373
11. Figuero E, Nóbrega DF, García-Gargallo M, Tenuta LMA, Herrera D, Carvalho JC. Mechanical and chemical plaque control in the simultaneous management of gingivitis and caries: a systematic review. Journal of Clinical Periodontology. 2017;44(18):S116-134. https://doi.org/10.1111/jcpe.12674
12. Folayan MO, Obiyan MO, Olaleye AO. Association between water, sanitation, general hygiene and oral hygiene practices of street-involved young people in Southwest Nigeria. BMC Oral Health. 2020;20:32. https://doi.org/10.1186/s12903-020-1022-z
13. Gallie A. Home use of interdental cleaning devices and toothbrushing and their role in disease prevention. Evidence-Based Dentistry. 2019;20:103-104.
14. Gavriilidou NN, Belibasakis GN. Root caries: the intersection between periodontal disease and dental caries in the course of ageing. British Dental Journal. 2019;227(12):1063-7. https://doi.org/10.1038/s41415-019-0995-1
15. Hart I, Wells C, Tsigarida A, Bezerra B. Effectiveness of mechanical and chemical decontamination methods for the treatment of dental implant surfaces affected by peri-implantitis: a systematic review and meta-analysis. Clinical and Experimental Dental Research. 2024;10(1):e839. https://doi.org/10.1002/cre2.839
16. Huang Q, Dong X. Prevalence of periodontal disease in middle-aged and elderly patients and its influencing factors. American Journal of Translational Research.

2022;14:5677-5684.
17. Inquimbert C, Clement C, Couatarmanach A, Tramini P, Bourgeois D, Carrouel F. Oral hygiene practices and knowledge among adolescents aged between 15 and 17 years old during fixed orthodontic treatment: multicentre study conducted in France. International Journal of Environmental Research and Public Health.2022;19:2316. https://doi.org/10.3390/ijerph19042316
18. Jafer M, Patil S, Hosmani J, Bhandi SH, Chalisserry EP, Anil S. Chemical plaque control strategies in the prevention of biofilm-associated oral diseases. Journal of Contemporary Dental Practice. 2016;17(4):337-43.
19. Jepsen S, Blanco J, Buchalla W, Carvalho JC, Dietrich T, Dörfer C, *et al*. Prevention and control of dental caries and periodontal diseases at individual and population level: consensus report of group 3 of joint EFP/ORCA workshop on the boundaries between caries and periodontal diseases. Journal of Clinical Periodontology. 2017;44:S85-93.
20. Jevdjevic M, Listl S. Global, regional, and country-level economic impacts of oral conditions in. 2019. Journal of Dental Research. 2025;104(1):17-21.
21. Jiao Y, Tay FR, Niu L, Chen JH. Advancing antimicrobial strategies for managing oral biofilm infections. International Journal of Oral Science. 2019;11:28. https://doi.org/10.1038/s41368-019-0062-1
22. Kaiser HF. An index of factorial simplicity. Psychometrika. 1974;39(1):31-36.
23. Kim SJ, Lee JY, Kim SH, Cho HJ. Effect of interdental cleaning devices on proximal caries. Community Dentistry and Oral Epidemiology. 2021;50:414-420 https://doi.org/10.1111/cdoe.12690
24. Kinane DF, Marshall GJ. Periodontal manifestations of systemic disease. Australian Dental Journal. 2001;46(1):2-12.
25. Konstantopoulou K, Kossioni AE. Association between oral hygiene information sources and daily dental and denture care practices in urban community-dwelling older adults. Journal of Clinical Medicine. 2023;12:2881. https://doi.org/10.3390/jcm12082881
26. Leite FRM, Nascimento GG, Scheutz F, López R. Effect of Smoking on Periodontitis: A Systematic Review and Meta-regression. American Journal of Preventive Medicine. 2018;54(6):831-841. DOI:10.1016/j.amepre.2018.02.014
27. Li Y, Xiang Y, Ren H, Zhang C, Hu Z, Leng W, *et al*. Association between periodontitis and dental caries: a systematic review and meta-analysis. Clinical Oral Investigations. 2024;28:306.
28. Lipsky MS, Singh T, Zakeri G, Hung M. Oral Health and Older Adults: A Narrative Review. Dental Journal. 2024;12:30. https://doi.org/10.3390/dj12020030
29. Marchesan JT, Morelli T, Moss K, Preisser JS, Zandona AF, Offenbacher S, *et al*. Interdental Cleaning Is Associated with Decreased Oral Disease Prevalence. Journal of Dental Research. 2018;97:773-778.
30. Martin SL, Su S, Crespo CJ, Hung M. Men and Oral Health: A Review of Sex and Gender Differences. American Journal of Men's Health. 2021;15(3). doi.org/10.1177/15579883211016361
31. Mišković I, Kuiš D, Špalj S, Pupovac A, Prpić J. Periodontal Health Status in Adults Exposed to Tobacco Heating System Aerosol and Cigarette Smoke vs. Non-Smokers: A Cross-Sectional Study. Dentistry Journal. 2024;12:26. doi:10.3390/dj12020026
32. Ng E, Lim LP. An Overview of Different Interdental Cleaning Aids and Their Effectiveness. Dentistry Journal. 2019;7(2):56. doi:10.3390/dj7020056
33. Nguyen TM, Tonmukayakul U, Le LKD, Calache H, Mihalopoulos C. Economic evaluation of preventive interventions for dental caries and periodontitis: A systematic review. Applied Health Economics and Health Policy. 2022;21:53-70.
34. Nunnally JC, Bernstein IH. Psychometric theory (3rd ed.). New York, NY: McGraw-Hill. 1994.
35. Oliveira LM, Pazinatto J, Zanatta FB. Are oral hygiene instructions with aid of plaque-disclosing methods effective in improving self-performed dental plaque control? A systematic review of randomized controlled trials. International Journal of Dental Hygiene. 2021;19:239-254. DOI:10.1111/idh.12491
36. Patel RA, Wilson RF, Palmer RM. The Effect of Smoking on Periodontal Bone Regeneration: A Systematic Review and Meta-Analysis. Journal of Periodontology. 2012;83(2):143-155.
37. Sabbahi DA, Alnahdi DO, Alsubaie RT, Aloufi WS. The Knowledge and Awareness Regarding usage of Interdental Water Flosser Devices among Saudi Community. Journal of Research in Medical and Dental Science. 2021;9(10):248-252.
38. Shankar T, Gowd S, Suresan V, Mantri S, Saxena S, Mishra P, *et al*. Denture Hygiene Knowledge and Practices among Complete Denture Wearers. The Journal of Contemporary Dental Practice. 2017;18(8):714-721.
39. Slot DE, Dörfer CE, Van der Weijden GA. The efficacy of interdental brushes on plaque and parameters of periodontal inflammation: a systematic review. International Journal of Dental Hygiene. 2008;6(4):253-264. DOI:10.1111/j.1601-5037.2008.00331.x
40. Su S, Martin SL, Licari FW, Hung M. Comparing oral health behaviours of men and women in the United States. Journal of Dentistry. 2022;122:104157.
41. Szalewski L, Pietryka-Michałowska E, Szymanska J. Oral hygiene in patients using removable dentures. Polish Journal of Public Health. 2017;127(1):28-31.
42. Tadin A, Badrov M. Oral Health Knowledge, Self-Assessed Oral Health Behavior, and Oral Hygiene Practices among the Adult General Population in Croatia. Healthcare. 2023;12(1):88. doi:10.3390/healthcare12010088
43. Valenzuela MJ, Waterhouse B, Aggarwal VR, Bloor K, Doran T. Effect of sugar-sweetened beverages on oral health: a systematic review and meta-analysis. European Journal of Public Health. 2021;31(1):122-129. doi.org/10.1093/eurpub/ckaa147
44. Vyas T, Bhatt G, Gaur A, Sharma C, Sharma A, Nagi R. Chemical plaque control - A brief review. Journal of Family Medicine and Primary Care. 2021;10(4):1562-1568. doi:10.4103/jfmpc.jfmpc_2216_20
45. Watt RG, Steele JG, Treasure ET, White DA, Pitts NB. Adult Dental Health Survey: implications of findings for clinical practice and oral health policy. British Dental Journal. 2020;208(3):107-112.
46. World Health Organization (WHO). Oral health resolution [Internet]. 2021 [cited. 2025 Jan]. https://apps.who.int/gb/ebwha/pdf_files/EB148/B148_R1-en.pdf
47. Worthington HV, MacDonald L, Poklepovic Pericic T, Sambunjak D, Johnson TM, Imai P, *et al*. Home use of

interdental cleaning devices, in addition to toothbrushing, for preventing and controlling periodontal diseases and dental caries. Cochrane Database of Systematic Reviews. 2019;(4):CD012018. DOI:10.1002/14651858.CD012018.pub2
48. Yu LX, Wang X, Feng XP, Tai BJ, Hu DY, Wang B, *et al*. The relationship between different types of caries and periodontal disease severity in middle-aged and elderly people: findings from the 4th National Oral Health Survey of China. BMC Oral Health. 2021;21:229. https://doi.org/10.1186/s12903-021-01585-1
49. Zemedikun DT, Chandan JS, Raindi D, Rajgor AD, Gokhale KM, Thomas T, *et al*. Burden of chronic diseases associated with periodontal diseases: a retrospective cohort study using UK primary care data. BMJ Open. 2021;11(12):e048296.
50. Zini A, Mazor S, Timm H, Barker ML, Grender JM, Gerlach RW, *et al*. Effects of an oral hygiene regimen on progression of gingivitis/early periodontitis: A randomized controlled trial. Canadian Journal of Dental Hygiene. 2021;55(2):85-94.
51. Zhang L, Waselewski M, Nawrocki J, Williams I, Fontana M, Chang T. Perspectives on dental health and oral hygiene practice from US adolescents and young adults during the COVID-19 pandemic. PLoS ONE. 2023;18:e0280533.

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