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study

Correlation between dental-plaque accumulation and gingival health in periodontal-maintenance patients

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Background

The relationship between dental plaque and periodontal diseases was demonstrated more than half a century ago. Subsequent research proved that the development and progression of periodontitis could be prevented by treating gingivitis. Effective personal oral-hygiene (pOH) measures play a fundamental role in achieving and maintaining periodontal health, so it is essential to establish these measures as a lifelong daily activity.

Despite the recommendation of the American Dental Association to perform pOH twice daily, data have suggested that pOH once per day could be sufficient to maintain gingival health in patients, whether or not they have a history of periodontitis.

While effective daily pOH showed a decrease in the correlation between the accumulation of dental plaque and gingival inflammation, prolonged intervals of pOH may promote changes in dental-plaque composition that favour bacterial pathogenicity. In non-periodontitis patients, the correlation between dental-plaque accumulation and gingival inflammation was shown to be weak for short pOH intervals compared to long ones. Therefore, it could be hypothesised that comparable correlations between dental plaque and gingival inflammation relative to pOH are present in patients with a history of periodontitis.

Aims

The aim of this study was to assess the correlation between dental-plaque accumulation and gingival health in patients under periodontal maintenance who perform pOH at short and extended intervals.

Materials & methods

- This randomised clinical trial enrolled 42 periodontally treated patients presenting proximal attachment loss of ≥3mm at ≥2 non-adjacent teeth, attending a maintenance programme (recalls at 4-6 months).
- All subjects were randomly assigned to one of the three groups based on the pOH interval, performed at intervals of 12, 24, or 48 hours.
- At baseline, 30 days, and 90 days, the following parameters were recorded: Plaque index (PI), gingival index (GI), probing depth (PD), clinical attachment level (CAL), and bleeding on probing (BoP) at six sites per tooth, excluding third molars.
- All patients received a soft multi-bristle toothbrush, dental floss and/or interdental brushes, fluoride dentifrice, and a fluoride mouthwash to perform oral hygiene.
- Clinical examinations were performed immediately prior to scheduled pOH events. Examinations were performed by two blinded and calibrated examiners.
- Subjects showing 30% or more sites with gingival bleeding during the study were excluded.
- Subjects performing their oral hygiene at 12- or 24-hour intervals (G12/G24) were allocated to the same group and compared to the patients performing pOH every 48 hours (G48).
- The primary outcome of this study was to evaluate the correlation between dental-plaque accumulation (mean PI) and gingival health (mean GI and BoP).
- The secondary outcome of this study was to investigate the correlation between gingival bleeding (GI score 2) and BoP.
- For statistical analysis, both descriptive and analytic tests were performed.

Table 1: Mean (SD) of Plaque Index (PI) and Gingival Index (GI) according to experimental groups at baseline, 30 and 90 days

	PI			GI		
	Baseline	30 days	90 days	Baseline	30 days	90 days
G12/24	0.22 (0.14)$^{A.a}$	0.42 (0.24)$^{A.b}$	0.49 (0.30)$^{A.b}$	0.64 (0.26)$^{A.a}$	0.76 (0.22)$^{A.b}$	0.81 (0.25)$^{A.b}$
G48	0.28 (0.23)$^{A.a}$	0.70 (0.42)$^{B.b}$	1.10 (0.46)$^{B.c}$	0.60 (0.21)$^{A.a}$	0.99 (0.18)$^{B.b}$	1.12 (0.13)$^{B.c}$

Note: Linear Mixed Models. Different uppercase letters demonstrate intergroup differences (p<0.05). Different lowercase letters show intra-group differences ($p < 0.05$). G12/24: $n = 28$ at baseline and 30 days, $n = 26$ at 90 days. G48: $n = 14$ at baseline and 30 days, $n = 12$ at 90 days.

Table 2: Correlation between Gingival Index (GI) score of 2 and bleeding on probing (BoP) according to individual group at baseline, 30 and 90 days

	All sites			PD≤ 3mm			PO> 3 mm		
	Baseline	30 days	90 days	Baseline	30 days	90 days	Baseline	30 days	90 days
G12/24	0.17[a]	0.23[a]	0.28[a]	0.17[a]	0.25[a]	0.28[a]	0.13[a]	0.16[a]	0.27[a]
G48	0.19[a]	0.30[a]	0.35[a]	0.17"	0.32[a]	0.35[a]	0.28[a]	0.17[a]	0.33[a]

Note: All sites: G12/24 $n = 3,642$ at baseline, 30 and 90 days $n = 3,390$; G48 $n = 1,638$ at baseline, 30 and 90 days $n = 1,380$. PD≤3 mm: G12/24 $n = 3,313$ at baseline, 30 and 90 days $n = 3,066$; G48 $n = 1,480$ at baseline, 30 and 90 days $n = 1,228$. PD>3 mm: G12/24 $n = 329$ at baseline, 30 and 90 days $n = 324$; G48 $n = 158$ at baseline, 30 and 90 days $n = 152$.
[a]Spearman correlation coefficient ($p < 0.001$).

Results

- No statistically significant differences (p>0.05) could be observed between the two study groups regarding the baseline subjects' demographics and clinical characteristics.
- In the G12/24 group, there was a significant increase (p<0.05) for both GI and PI from baseline to 30 days, but with no further significant change up to 90 days.
- In the G48 group, there was a significant increase (p<0.05) for both GI and PI from baseline to 30 days, with a further significant increase up to 90 days.
- For both study groups, a reduction in healthy sites was reported. In the G12/24 group, there was a reduction of approximately 20% of plaque-free sites over 90 days, while in the G48 group the reduction was 50% compared to baseline.
- G12/24 presented fewer than 10% sites with gingival bleeding after 90 days while G48 presented 19%. This difference was statistically significant (p<0.05).
- BoP increased from 13% to 22% over 30 days and to 25% over 90 days in the G48 group. For the G12/24 group, this increase was from 13% to 16% over 30 days and to 19% over 90 days. This difference was statistically significant (p<0.05).
- There were statistically significant correlations between PI and GI and between PI and BoP for both groups. The correlation coefficient between PI and BoP remained unchanged for G12/24 but increased for G48. The correlation between PI and GI increased for both groups until day 30 and remained unchanged from day 30 to day 90.

Limitations

- Selection bias may have occurred as subjects showing 30% or more sites with gingival bleeding during the experimental period were excluded from the study.
- Included subjects presented an adequate pOH (FMBS ≤7.5%) and an absence of risk factors, which may decrease the external validity of the results and overestimate the correlations between dental-plaque accumulation and gingival inflammation.
- A subjectively scored index (GI) was used to assess periodontal health, which may introduce variability in the results.
- The correlation-coefficient values were weak.

Conclusions & impact

- The frequency of pOH measures has an influence on the correlation between dental-plaque accumulation and gingival inflammation in patients in periodontal maintenance programmes.
- Extended pOH intervals compromise gingival health when compared to short pOH intervals.
- There is a positive correlation between dental-plaque accumulation with GI and BoP and this correlation was reinforced in the G48 group throughout the study.
- The pOH interval should be considered because it influences the correlation between dental-plaque accumulation and gingival inflammation – especially when assessed with BoP – in subjects with a history of periodontitis attending a maintenance programme.
- Extended pOH intervals were not sufficient to maintain plaque levels and gingival status compatible with gingival health.

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