Original Article

Evaluation of Effects of Scaling with and without Polishing on Oral Hygiene Clinical Parameters – A Concurrent Parallel Randomized Trial

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Abstract

Introduction: Good oral health is a crucial indicator of overall well-being. Oral hygiene maintenance and care is the practice of keeping the oral cavity clean and disease free. The main objective of this study was to evaluate the effects of scaling and polishing on oral hygiene clinical parameters at different intervals. **Materials and Methods:** A concurrent parallel randomized trial was carried out among 60 college students in the Namakkal district. Subjects were randomly assigned into two groups, the scaling followed by the polishing group and the scaling without polishing group. This was a three-point assessment (baseline, 2nd week, and 3rd week) for plaque, gingival, and marginal line calculus index scores. Data were analyzed using parametric tests: independent *t*-test and repeated measures ANOVA. **Results:** A statistically significant difference was found for all three clinical parameters at the final 3rd-week follow-up between the two groups. Between the intervals, both the groups had a significant difference ($P < 0.05$) for plaque, gingival, and calculus index. **Conclusion:** Scaling followed by polishing had better results when compared to scaling without polishing. Microlocal irregularities, caused by scaling procedures, might be the cause for further accumulation of debris which can be reduced by polishing procedures.

Keywords: Calculus index, oral hygiene, plaque, scaling, tooth polishing

Introduction

Oral health refers to the physiological condition of the teeth, gums, and the entire orofacial system that helps to speak, eat, and smile. Good oral hygiene is essential to maintain overall physical and emotional well-being.[1] Compromising dental care can lead to various dental diseases or problems such as dental caries, gingivitis, and periodontitis, which are highly prevalent in developing countries.[2] Although they are highly preventable, utilization of dental services is limited in most countries which poses a major health burden affecting people throughout their life, which overall results in impaired oral health-related quality of life. From the strong evidence obtained from various areas of dental research, it has been proven that oral deposits enact a significant role in the advancement and progression of oral diseases.[2] Major deposits occur in the pits and grooves of the tooth that act as a reservoir for bacterial lodgment as it has no access to salivary flow and oral hygiene procedures. This influences the initial bacterial adhesion on the tooth surface.[3]

A frequent and consistent deposition of dental biofilm that adheres to the tooth surface is a prime factor for progression. Calculus formation mainly depends upon the amount of plaque present and the salivary constituents that facilitate the mineralization.[4] Eliminating such conditions entails self-oral hygiene measures and treatment that focus on scaling procedures to remove plaque and calculus that have built up in the supragingival and subgingival regions.[5]

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Received: 28-09-2022 **Revised:** 20-12-2022 **Accepted:** 29-05-2023 **Published:** 27-09-2023

Access this article online

Quick Response Code:

Website: www.jiaphd.org

DOI: 10.4103/jiaphd.jiaphd_202_22

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How to cite this article: Shanmugam S, Sundararajan S, Yasin M, Muthu KS, Shavi GR, Murali K. Evaluation of effects of scaling with and without polishing on oral hygiene clinical parameters – A concurrent parallel randomized trial. J Indian Assoc Public Health Dent 2023;21:264-9.

Scaling procedures tends to cause various microgrooves and surface irregularities on the tooth surface. Such micro-irregularities act as a factor for microbial adhesion and tend to cause the accumulation of plaque onto the tooth surface.[6] In order to prevent such conditions, polishing of the tooth surface is done following a scaling procedure. Hence, the current study was undertaken to know whether any difference exists between the two procedures on the further accumulation of supragingival plaque and calculus at different intervals.

Materials and Methods

Study design

A concurrent parallel randomized clinical trial was carried out among 60 college students in the Namakkal district aged 18–24 years. The study duration was about 3 weeks from July to August 2022.

Sample size

The sample size was calculated using G*Power 3.1 software, Heinrich Heine Universitat Dusseldorf. Germany with an effect size of 0.8, alpha 0.05, and power of the study of 85%. A total of 60 samples were obtained, and considering two groups, it was divided equally into 30 subjects for each group. A larger effect size was considered because the previous research findings had practical significance.[4]

Eligibility criteria

1. Inclusion criteria
    - Presence of six healthy teeth per quadrant
    - Well-aligned teeth
    - Subjects with moderate gingivitis
    - Systemically healthy.
2. Exclusion criteria.
    - Gingival recession
    - Under orthodontic treatment
    - Under medications for any systemic illness.

Randomization

A total of 60 subjects were selected for the study based on the inclusion and exclusion criteria. After obtaining informed consent, the subjects were randomly allocated into the study and control groups by simple random sampling (lottery method) Sequentially numbered, Opaque, Sealed Envelope (SNOSE) technique of allocation concealment. The control group had 30 subjects with only scaling procedures, and the study group had 30 subjects with scaling followed by polishing procedures [Figure 1].

Intervention

Initially, the baseline index values were recorded for plaque index (PI) (Silness J. and Loe H, 1964), gingival index (GI) (Löe, 1967),[7] and marginal line calculus index (MLCI).[8]

Following initial assessment, ultrasonic scaling was performed for both the study group and the control group in order to eliminate the plaque and calculus and make the subjects free from deposits. This was examined visually after drying the tooth surface for the presence of any leftover deposits on the tooth surface.

After the scaling procedure, polishing of tooth surface was done with a rubber cup and pumice in the study group to obtain a smooth surface. Oral hygiene instructions were given to both the groups and recommended not to use any mouthwash during the study period. A standard toothbrush and toothpaste were delivered to all the subjects to achieve a uniform condition. Three examiners were involved in the study: two performed the clinical procedures and one was blinded to experimental procedures and evaluated the clinical parameters. PI, GI, and MLCI were measured at an interval of 2 weeks and 3 weeks after the clinical procedure in both the groups.

Measurement reproducibility

The examiners were calibrated and standardized in the department to ensure uniform interpretation of clinical scores among two examiners who performed the clinical procedures. The inter-examiner reliability had a kappa statistics value of 0.81 and intra-examiner reliability of 0.85 for the parameters which was found to be acceptable.

Statistical analysis

The results were analyzed using SPSS software version 20.0 software (SPSS Inc., Chicago, IL, USA). Mean and standard deviation for all the parameters was obtained. Comparisons between the two groups for three parameters were done using independent sample *t*-test. Comparison of the mean within the groups was done using repeated measures ANOVA. *Post hoc* analysis was done for multiple pairwise comparisons. The level of significance was set at $P < 0.05$.

Results

A total of 60 subjects were enrolled. At baseline plaque scores for both the groups were poor and gingival scores were at a moderate level which improved in the 2nd week to fair PI and mild gingival scores. From baseline, there was a reduction in the MLCI scores in the 2nd-week interval. At the 3rd-week interval, a slight increase in mean scores was observed in all three clinical parameters in the without polishing group where the polishing group remained with the same scores [Figure 2].

At baseline, since all the subjects were in the same level, there were no significant changes observed in the polishing and without polishing groups in all three clinical parameters. At the 2nd week, a highly statistically significant difference ($P < 0.001$) was observed for plaque and MLCI except for the gingival scores ($P < 0.091$). For all three clinical parameters, the results were highly statistically significant at the 3rd week ($P < 0.05$) between the polishing and without polishing groups [Table 1].

All the clinical parameters were found to be highly statistically significant ($P < 0.001$) in the polishing group between baseline, 2nd week, and 3rd week, whereas the comparison was found to be significant ($P < 0.05$) in the without polishing group [Table 2].

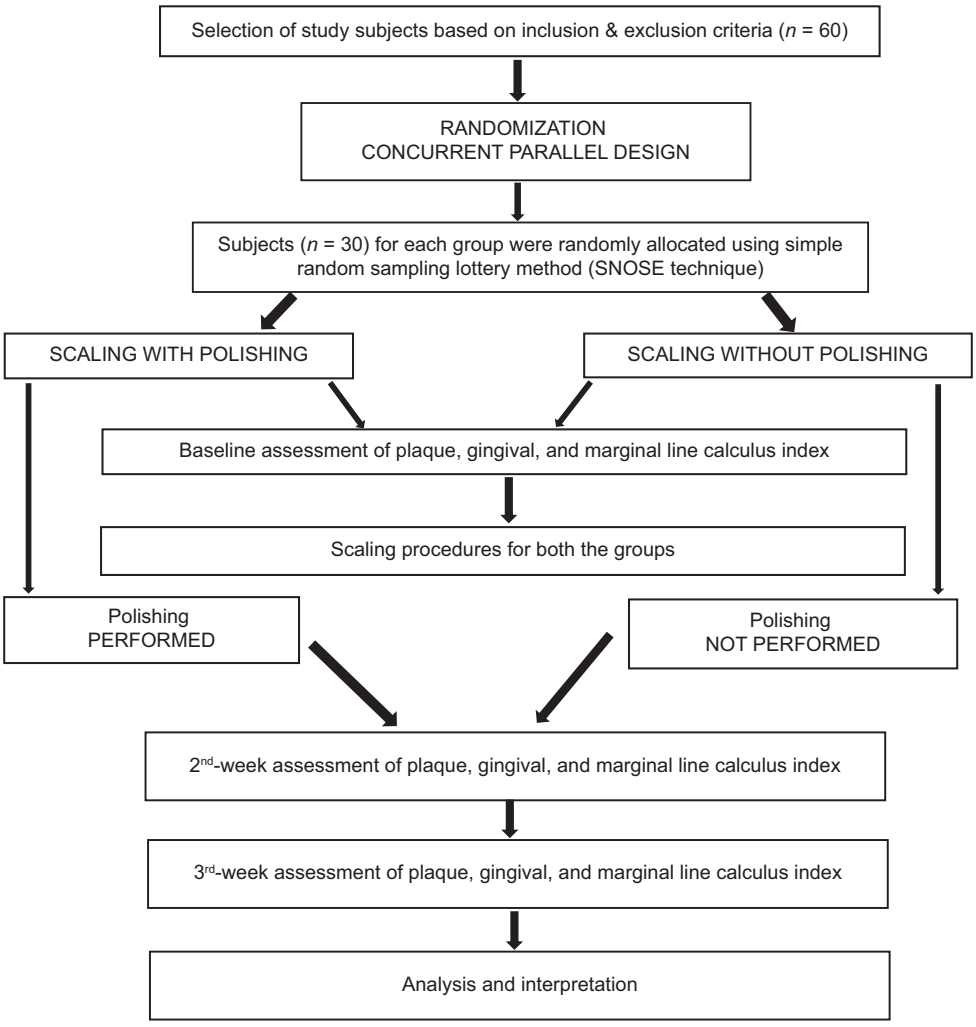

Figure 1: Schematic representation of subjects' selection and assessment

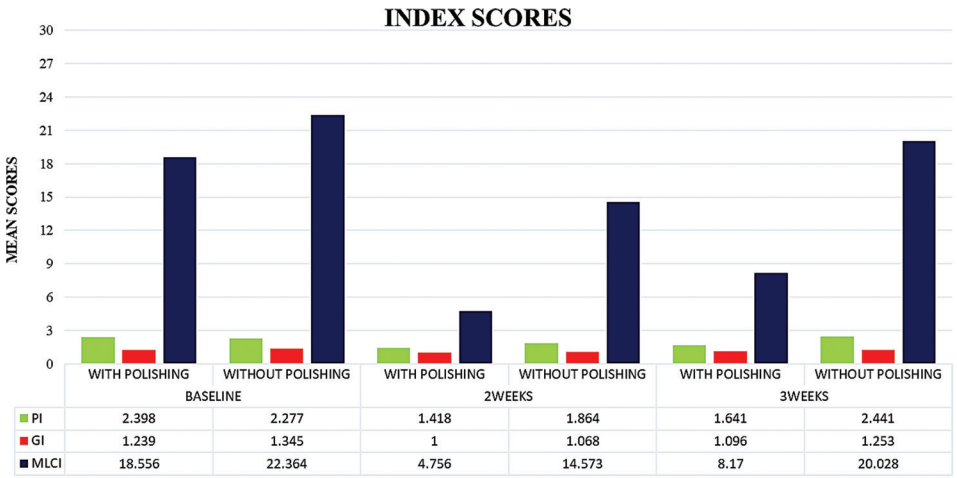

Figure 2: Mean scores of two groups at different intervals. PI: Plaque index, GI: Gingival index, MLCI: Marginal line calculus index

Post hoc analysis showed a statistically significant difference among the polishing group for all the mean plaque, gingival, and marginal line calculus scores. The without polishing group had a significant difference only at the level of comparison between the 2nd week and the 3rd week except for the MLCI where it was found to be significant between baseline and 2nd-week intervals [Table 3].

Table 1: Comparison of plaque, gingival, and marginal line calculus index at three different time intervals between the two groups using independent *t*-test

Time interval	Clinical parameters	Group	Mean±SD	*t*	*P*
Baseline	PI	With polishing	2.398±0.423	0.685	0.498
		Without polishing	2.277±0.667		
	GI	With polishing	1.239±0.233	−1.424	0.162
		Without polishing	1.345±0.239		
	MLCI	With polishing	18.55±7.834	−1.380	0.176
		Without polishing	22.36±9.542		
2 weeks	PI	With polishing	1.418±0.128	−3.807	0.000*
		Without polishing	1.864±0.507		
	GI	With polishing	1.000±0.000	−1.733	0.091
		Without polishing	1.068±0.175		
	MLCI	With polishing	4.75±1.074	−7.139	0.000*
		Without polishing	14.57±6.055		
3 weeks	PI	With polishing	1.641±0.088	−5.783	0.000*
		Without polishing	2.441±0.612		
	GI	With polishing	1.096±0.049	−2.948	0.005*
		Without polishing	1.253±0.233		
	MLCI	With polishing	8.170±1.600	−9.114	0.000*
		Without polishing	20.02±5.594		

*P<0.05. PI: Plaque index, GI: Gingival index, MLCI: Marginal line calculus index, SD: Standard deviation

Table 2: Comparison of clinical parameters between three different time intervals using repeated measures ANOVA

Group	Clinical parameters	Time interval	Mean±SD	*F*	*P*
With polishing	PI	Baseline	1.819±0.494	77.929	0.000**
		2 weeks			
		3 weeks			
	GI	Baseline	1.111±0.167	15.239	0.000**
		2 weeks			
		3 weeks			
	MLCI	Baseline	10.49±7.482	47.618	0.000**
		2 weeks			
		3 weeks			
Without polishing	PI	Baseline	2.194±0.638	4.930	0.011*
		2 weeks			
		3 weeks			
	GI	Baseline	1.222±0.243	8.400	0.001*
		2 weeks			
		3 weeks			
	MLCI	Baseline	18.98±7.876	6.031	0.004*
		2 weeks			
		3 weeks			

**P<0.001, *P<0.05. PI: Plaque index, GI: Gingival index, MLCI: Marginal line calculus index, SD: Standard deviation

Discussion

Maintenance of oral hygiene varies from person to person due to different oral hygiene methods practiced and the brushing aids used among them. However, various internal and external factors also come into considerations, such as diet, nutrition, alcohol, tobacco usage, and systemic conditions which are associated with oral health. Poor oral hygiene results in the formation of calculus, gingivitis, periodontitis, and dental caries.

Accumulation of plaque for a long period of time results in the formation of calculus which ultimately progresses to gingivitis. Due to negligence and lack of knowledge, people tend to use their toothbrushes over a long period of time even after the Flaring of the bristles which tend to lose their efficacy and result in poor oral hygiene.

Removal of supragingival plaque by scaling is considered one aspect of dental prophylaxis. It is necessary to regularly remove the accumulated plaque and calculus in order to prevent further progression of the disease. According to the American Academy of Pediatric Dentistry,[9] the beneficial effects of scaling in the treatment of chronic gingivitis and periodontitis have been validated.

Scaling along with polishing the tooth surface was found to decrease the amount of plaque accumulation by removing the surface roughness, which acts as a reservoir for bacterial adhesion and prevents tooth decay.[10] A review[11] states that an increase in the surface roughness above 0.2 μ resulted in a simultaneous increase in the accumulation of plaque, thereby increasing the risk of gingivitis and periodontitis.

Including all these factors into consideration, a parallel randomized trial was carried out to determine the accumulation of plaque in the subsequent intervals following scaling with and without polishing. Polishing with abrasive paste might lead to discomfort for most of the individuals by causing sensitivity and traumatizing the gingiva. All these things have been reassessed at the following intervals to eliminate the effect caused by these procedures.

Plaque score

Plaque scores at baseline showed a nonsignificant difference between the polishing and without polishing groups. The mean

Table 3: *Post hoc* analysis for multiple comparisons of three clinical parameters between different intervals

Dependent variable	Time interval (I)	Time interval (J)	Mean difference (I–J)	*P*
PI 1	Baseline	2 weeks	0.980*	0.000**
		3 weeks	0.757*	0.000**
	2 weeks	3 weeks	−0.222*	0.027*
GI 1	Baseline	2 weeks	0.239*	0.000**
		3 weeks	0.143*	0.005*
	2 weeks	3 weeks	−0.096	0.095
MLCI 1	Baseline	2 weeks	13.799*	0.000**
		3 weeks	10.386*	0.000**
	2 weeks	3 weeks	−3.413	0.072
PI 2	Baseline	2 weeks	0.413	0.100
		3 weeks	−0.164	1.000
	2 weeks	3 weeks	−0.577*	0.011*
GI 2	Baseline	2 weeks	0.277*	0.001*
		3 weeks	0.092	0.563
	2 weeks	3 weeks	−0.185*	0.028*
MLCI 2	Baseline	2 weeks	7.791*	0.004*
		3 weeks	2.336	0.943
	2 weeks	3 weeks	−5.454	0.064

*P<0.05, **P<0.001. 1 - with polishing, 2 - without polishing. PI: Plaque index, GI: Gingival index, MLCI: Marginal line calculus index

scores have reduced in the 2nd week and increased slightly at the 3rd-week interval for both the groups and were found to be statistically significant ($P < 0.05$). It was contrary to a study[3] where the plaque scores were found to be increased in the subsequent intervals from baseline to 1st-, 3rd-, and 6th-month intervals between the polished and unpolished groups and were statistically significant ($P < 0.05$) between intervals. In our study, accumulation of plaque and its clinical finding seems to have increased in the final follow-up which states that proper maintenance is necessary for good oral hygiene.[12] The without polishing group exhibited a higher score in the 3rd week than the polished group and was found to be significant which was similar to a study.[4,13] A study compared the plaque mean scores at pre-and posttreatment of polishing which showed a significant reduction in plaque scores ($P < 0.05$) which was similar to our study.[14]

Gingival scores

Assessment of gingival scores at three different intervals (baseline, 2nd week, and 3rd week) was done similar to a study[15] who conducted experimental gingivitis in humans at an interval of 7, 14, and 21 days to assess oral hygiene maintenance, and it was found to be effective. Plaque formation is usually high at the gingivitis site,[16] and on the removal of plaque and oral hygiene maintenance, the gingival inflammation reverts back to normal condition. Gingival scores reduced in the 2nd-week interval and were found to be nonsignificant between the polishing and without polishing groups and had a significant reduction in the 3rd-week interval. This was not in accordance with previous studies[3,4] where a highly significant difference was noted between the two groups from baseline to final follow-up intervals.

Marginal line calculus index scores

Scaling procedures are done to remove any local irritants (debris, plaque, stains, and calculus) to prevent the progression of the disease conditions.[17] The calculus index score was found to have a significant difference ($P < 0.05$) in the 2nd–3rd-week interval which shows that the polishing and without polishing groups had reduced the calculus formation which was similar to a previous study.[4]

Limitations

For the generalizability of the results, larger sample size from various institutions is required to substantiate the results. A longitudinal study is required to evaluate the subsequent maintenance in posttreatment visit. No disclosing agent was used for plaque disclosure to ensure effective plaque removal. Alternate to rubber cup polishing, air polishing has improved efficiency in terms of duration and comfort level of patients during treatment procedures, so further studies are recommended with air polishing for benefit and acceptance level of patients.

Conclusion

In our study, polished surfaces were found to be more effective because adhesion of debris and maturation is less when compared to unpolished surface. All these factors should be considered to have a long-term effect on the scaling procedures and eliminate the cause that further progresses the disease conditions. Thus, polishing might limit the plaque accumulation and helps in maintaining a good oral hygiene.

Public health significance

Oral diseases are more common than other noncommunicable diseases and are considered a global public health concern since they are interlinked to social inequalities and high-risk behaviors. The primary level of prevention in the population has not yet attained, mainly due to a lack of knowledge, ignorance, and underutilization of dental services. Public health approaches for periodontal disease prevention and control are still lacking. Dental workforce and policies should focus primarily on oral health through a health education approach, and treatment modalities should shift from a problem-centered to a patient-centered approach. This helps to reduce the burden of oral diseases, which in turn improves the quality of life.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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