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Original Article

Effectiveness of Oral Hygiene Instructions Utilizing Home Task to Improve Plaque and Gingival Indices in Children. A Randomized Controlled Trial

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ABSTRACT

Objective: The purpose of this randomized controlled trial was to evaluate the effectiveness of Individual Oral Hygiene Instructions (IOHIs) utilizing a home task in improving plaque and gingival indices in children. **Methods:** The baseline plaque and gingival indices of 23 children (8–12 years) were measured by a blinded evaluator, then each child received IOHIs from a pediatric dentist. Subjects were randomly allocated into two groups: the intervention group received Individual Oral Hygiene Instructions In addition to the Home Task (IOHIHT). The home task was taking a photo by the included child of their teeth after nighttime brushing and share it with their parent. The control group received only IOHIs. A follow-up visit was scheduled 3–4 weeks later to re-measure plaque and gingival indices. Between and within groups differences were compared using Mann–Whitney U-test and Wilcoxon matched pairs signed rank test, respectively. **Results:** There was no significant difference between IOHIHT and IOHI groups in plaque and gingival indices (P = 0.87 and P = 0.32, respectively) at the follow-up visit. There was a significant decrease in plaque index (P = 0.03) for the IOHIHT group, the median in baseline was 0.96 versus 0.42 in follow-up, and gingival index (P = 0.003), the median was 1.04 in baseline versus 0.33 in follow-up. There was also a significant decrease in plaque index (P = 0.009) for the IOHI group, median in baseline was 1 versus 0.42 in follow-up, and gingival index (P = 0.005), median was 1.17 in baseline versus 0.29 in follow-up. **Conclusion:** IOHIs contributed to a significant reduction in plaque and gingival indices in selected subjects of children. The addition of dental home task did not appear to result in further improvement.

Keywords: Children, gingival index, home task, oral hygiene, plaque index, randomized control trial

Introduction

Daily improvement of oral hygiene is essential in maintaining healthy teeth and periodontium in children. For better oral health outcomes, children and their parents should be willing to change their daily dental behavior in tooth brushing.[1-5] Behaviors and routines are built and maintained from childhood, making them more difficult to change in adulthood. Therefore, dental professionals can play a vital role in improving oral health in children through education, counseling, and behavioral change interventions.

Different techniques in behavioral change may play a significant role in a patient's behavior. Techniques such as goal setting, goal review, monitoring specified behaviors, behavioral rehearsal, home task, motivational interviewing, and reinforcement can help to improve oral hygiene.[6-8] Building confidence, skills, and motivation to maintain behavioral changes increases the likelihood of being effective.[9,10] Artificial intelligence (AI) and virtual assistance may answer personalized questions and provide more interactive educational material but with limited evidence perhaps due to recent development.[11] In a review article, Khafid *et al*. found positive outcomes when Internet of things services were utilized to improve oral health in children.[12] The use of mobile smart phone with gamification was also utilized to improve oral hygiene.[13] Reviews on adults and adolescents revealed more favorable outcomes for interventions with behavioral change when compared with traditional dental education.[14,15] However, a low quality of evidence of behavioral changes in

improving adult and adolescent oral health behavior was found; implying that additional research is likely to change the estimate of the behavioral effect.[15] Furthermore, these studies were conducted on adults and adolescents, not children. Therefore, this Randomized Controlled Trial (RCT) aimed to evaluate the effectiveness of Individual Oral Hygiene Instructions (IOHIs) given by a pediatric dentist and compared with an addition of a home task as a behavioral change intervention; the measured outcomes were plaque and gingival indices.

Methods

Trial design

The study was conducted as a RCT with the following features: simple randomization with a block design of four blocks, parallel arms, a 1:1 allocation ratio, a total of two groups, and stratified by gender with equal allocation. Subjects were recruited from the dental department in Security Forces Comprehensive specialized clinics in Makkah City, Saudi Arabia, from June 2022 to December 2022. Ethical approval was obtained from Security Forces Hospital in Makkah, IRB no. 0428-050521. Parental consent was also acquired from the parents of all participants.

Participants

The following eligibility criteria were implemented:

- Age (8–12 years)
- The pediatric subject can take a selfie photo of their teeth and send it to their parents with comments
- No physical or mental limitations to perform the assigned home task (taking photos of their teeth)
- No history of antibiotic use within the past 3 weeks
- No medical condition affecting the gingival health
- No history of comprehensive dental rehabilitation under general anesthesia
- No siblings were included or children living within the same household.

Outcomes

The following outcome variables were measured at baseline and then repeated at the follow-up session after 3–4 weeks:

- Plaque index[16]
- Gingival index[16]

The baseline measurement for outcome variables was performed before the oral hygiene instructions (i.e., before randomization) to ensure allocation concealment. The same blinded evaluator conducted the outcome measurement at the follow-up visit. Age in years, gender, and frequency of daily teeth brushing were also collected from the participants.

Interventions

Outcome variables were measured at baseline but before randomization. Subsequently, each subject was given a toothbrush and asked to brush their teeth like at home. After that, a disclosing agent was used to show potential surfaces covered with plaque that were missed with brushing. The pediatric dentist showed the plaque areas and assisted the patient in removing them using the toothbrush. Proper teeth brushing instructions were repeated using dental models. Furthermore, subjects were instructed to brush their teeth twice daily, two minutes each, following the modified bass technique. They were also instructed to floss their teeth at least once a day. Up to this point, all participants received the same IOHI from the same pediatric dentist (i.e., no randomization/grouping yet). Afterward, randomization was practiced, and participants were divided into two groups: one group was informed to take a daily selfie photo of their teeth after nighttime brushing and then send it to their parents as a home task for self-monitoring by the parent. If no photo was sent, the parent will send a reminder to the child. All photos were kept with the family and not shared with study personnel. This group was referred to as Individual Oral Hygiene Instruction with Home Task (IOHIHT). On the other hand, the other group received only IOHIs with no further action. The relevant tasks in the study were explained and clarified to the included parents and their children. For all study subjects, any necessary dental care was provided at baseline or follow-up visits [Figure 1].

Blinding

To ensure blinding, the bassline outcome variable was measured before randomization. Furthermore, coding by A or B was implemented for the two groups to maintain blinding in the follow-up visits. Intraexaminer reliability was measured for plaque and gingival indices using ten cases not included in the study.

Sample size

Since there were no similar papers published on this topic, a pilot study was conducted with ten subjects in each group.

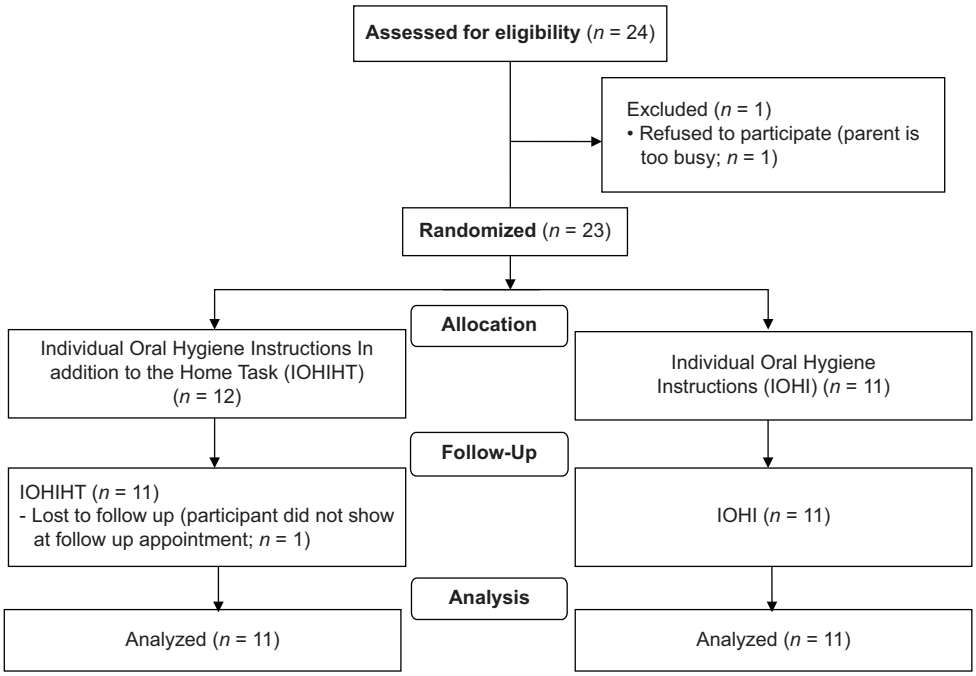

Figure 1: Flow chart of the included participants

Statistical analysis

Descriptive statistics included mean with standard deviation or median with interquartile range (IQR) were estimated. Due to the relatively small sample size, nonparametric statistical tests were used to compare the differences in plaque and gingival indices between the groups (Mann Whitney U test) and within the groups (Wilcoxon matched-pairs signed rank test). Statistical analyses were completed using complete case analysis. Intraclass correlation coefficient (ICC) was used for calibration. STATA software (Stata Corp LP, College Station, Texas, USA) was used for statistical analysis. A *P*-value of 0.05 or less was considered statistically significant.

Results

Intraexaminer ICC was more than 95% for both, plaque and gingival indices. A total of 22 subjects completed the study, 11 in each group. There was one subject lost to follow-up and was excluded from the analysis. There were 5 (45.5%) boys in the IOHIHT group and 5 (45.5%) boys in the IOHI group. The eligible age in this study ranged from 8 to 12 years. The median age was 9 in both groups. At baseline, about 7 (63.6%) of all subjects brushed their teeth two times or more daily. At baseline, the plaque index ($P = 0.92$) and gingival index ($P = 0.67$) were comparable between the intervention groups. At the end of the follow-up, 3–4 weeks from baseline, there was no significant difference between the groups in plaque index ($P = 0.87$) and gingival index ($P = 0.32$). For the baseline postcomparison, the IOHIHT group showed a significantly lower plaque index in the follow-up visit. Median 0.42 with IQR: 0.25–0.54, compared to the baseline visit, median 0.96 with IQR: 0.42–1.42, $P = 0.029$. Similarly, the IOHI group showed a significantly lower plaque index in the follow-up visit, median 0.42 with IQR: 0.29–0.63, compared to the baseline visit, median 1 with IQR: 0.67–1.2, $P = 0.0099$. For the baseline post comparison when the gingival index was measured, it also was significantly reduced in the IOHIHT group, the median in the baseline was 1.04 with IQR: 0.67–1.38 and 0.33 with IQR: 0.29–0.42 in the follow-up, $P = 0.03$. Similarly, the gingival index was significantly reduced in the IOHI group, median in the baseline was 1.17 with IQR: 0.63–1.25 and 0.29 with IQR: 0.21–0.5 in the follow-up, $P = 0.0051$ [Table 1].

Discussion

The current study evaluated the effectiveness of IOHIs with or without the addition of home task as behavioral change intervention in children on the commitment to oral health care. In the IOHIHT group, children received IOHIs from a pediatric dentist with the home task to take a daily selfie photo of their teeth after nighttime brushing and then send the photo to their parents. The findings showed no significant difference in plaque and gingival indices from the IOHI group, who received

Table 1: Baseline and 3–4 weeks follow-up for plaque and gingival indices in children after receiving individual oral hygiene instructions

Variable	Baseline (*n*=11)		*P*-value for IOHIHT group¥	Follow-up (*n*=11)		*P*-value for IOHI group¥
	IOHIHT	IOHI		IOHIHT	IOHI	
Plaque index	0.96 (0.42, 1.42)	1 (0.67, 1.2)	0.0291	0.42 (0.25, 0.54)	0.42 (0.29, 0.63)	0.0099
P-value*	0.92			0.87		
Gingival index	1.04 (0.67, 1.38)	1.17 (0.63, 1.25)	0.0033	0.33 (0.29, 0.42)	0.29 (0.21, 0.5)	0.0051
P-value*	0.6685			0.3219		

*Between-group differences tested by Mann Whitney U test. ¥Within group differences tested by Wilcoxon matched-pairs signed rank test. IOHIHT: Individual oral hygiene instructions in addition to the home task, IOHI: Individual oral hygiene instructions. The plaque and gingival indices were presented as median (Q2, Q3)

only IOHIs. However, the results revealed a significant reduction in the plaque and gingival indices scores in the follow-up visit compared to baseline, indicating improved oral hygiene in both groups.

The current findings revealed that the effect of the home task was relatively small, showing no significant difference between the intervention groups. One explanation can be attributed to the fact that the IOHIs during the baseline visit were as effective as improving plaque and gingival indices as taking a daily selfie photo at nighttime. This is possible because children practiced tooth brushing in the pediatric dentist's presence and watched the dentist explain the toothbrushing on the dental model. For this reason, the improvement in plaque and gingival indices was similar in both groups. This finding confirms earlier studies that compared three different methods of teaching tooth brushing in children. The tooth brushing methods included audiovisual, child as a model, and IOHIs.[17,18] These studies revealed that individual instructions were the most effective method in reinforcing oral hygiene in children.

Another possible reason for the similar findings in both groups is that it might be difficult for patients and parents to commit to taking daily photos for 3–4 weeks at nighttime. The nighttime is challenging for children to commit to the home task since children are getting tired before bedtime. A study on adults in Sweden showed a high commitment to home task (documenting their feelings and thoughts in a diary) for 3 weeks.[19] In that study, they revealed that writing a diary as a home task improved oral hygiene compared to the group who received only oral hygiene instructions. This result contradicts the current study's finding, which could be explained by the fact that the current study was conducted on children and not adults.

Another explanation is that children in both groups know there will be a follow-up visit to re-examine their oral hygiene in 3–4 weeks. The commitment to follow the pediatric dentist's instructions was relatively high, and compliance with follow-up was extremely high in this study. Therefore, longer follow ups to check oral hygiene in both groups might be recommended to evaluate the possible improvement in plaque and gingival indices.

The similar results in both groups raise the question of whether individually based oral hygiene instructions are sufficient since the IOHI group, who received only IOHIs, showed similar findings in oral hygiene to the IOHIHT group. This explanation could be supported by the outcomes within the groups, showing a significant reduction in the plaque and gingival indices between baseline and post.

The strength of the current findings of this randomized control trial supports the importance of expanding the scope of the investigation to include a larger sample size and longer follow-up visits. Furthermore, dental home task showed promising results on other populations,[19-21] encouraging the importance of IOHIs and dental home task.[19,22] The current study showed some limitations that might influence the current findings. First, the relatively small sample size might limit the generalizability of the obtained findings. Second, the follow-ups were scheduled after 3–4 weeks which were sufficient to measure possible gingival health improvement. However, it was a short time to consider in an intervention with lifelong behavioral change implications. Finally, it seems the nighttime dental home task were challenging for parents and children. Commitment may not be the best approach for the current population.

Conclusion

Based on the preliminary findings from the current study, one to one IOHIs resulted in a significant short-term reduction in plaque and gingival indices. The home task did not result in additional benefit over IOHIs alone.

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Ethical Approval

Ethical approval was obtained from Security Forces Hospital in Makkah, IRB no. 0428-050521.

Authors' Contributions

MMA, TSN, AMA and AAM designed the study; MMA and MSS performed the study; AAM analysed the data; AAM performed the statistical analysis; MMA wrote the manuscript; AAM commented on the manuscript; MMA and AAM revised the manuscript.

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