Effect of Various Motivation Methods on Oral Hygiene Index Scores of Fixed Orthodontic Patients

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Abstract

Orthodontic treatment using fixed appliances is a predisposing factor for plaque accumulation because dental cleaning is more difficult. The lack of patient motivation and compliance in maintaining oral hygiene during treatment is also a predisposing factor in plaque build-up. **Purpose**: This study aimed to determine which motivation methods most influence Oral Hygiene Index scores based on the Plaque Index and the Gingival Index. The study is a randomized, single-blind clinical trial with concealed allocation. The subjects comprised patients treated with fixed orthodontic appliances. The patients' Oral Hygiene Index scores prior to and after being exposed to oral hygiene improvement motivation methods were evaluated. Statistical data processing was performed using univariate analysis, a Kruskal–Wallis test, a Wilcoxon test, and a one-way ANOVA. Three motivation methods were employed—modelling, a printed catalogue and a video. We found a significant difference between the modelling and video groups, followed by the catalogueand video groups. The video motivation method had the most significant effect on decreasing the Oral Hygiene Index score. The most effective method to increase the motivation of patients to maintain dental hygiene and improve plaque and gingival scores was the video method.

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Introduction

The prevalence of malocclusion in Indonesia remains high at around 80% of the total population. Malocclusion is one of the major dental and oral health problems after dental caries and periodontal disease.[1] Orthodontic treatment using fixed appliances can change the environmental conditions in the oral cavity, resulting in increased plaque, changes in the composition of normal flora, gingivitis, hyperplastic gingiva and enamel decalcification or white spots around fixed appliances, especially if a patient's oral hygiene is very poor.[2] Tufekci found that the prevalence of white spot lesions ranges from 38% after 6 months' use of fixed orthodontic appliances to about 46% after 12 month' use. Several previous studies have reported changes in normal subgingival microflora shortly after the insertion of fixed orthodontic appliances, reflected by an increase in the amount of plaque, bleeding and the increased depth of sulcus upon probing.[3,4] The result is that treatment may last longer or may fail, and the benefit of orthodontic treatment for the patient is reduced.[5-8]

The literature discusses several methods of motivation to improve oral hygiene, including direct verbal motivation method without the use of media, written method is through the media that can be a booklet containing information and visual method is through intermediary media, such as a video showing proper dental hygiene.[2,9]

According to Zachrisson, the main factors causing periodontal disease are bacteria and dental plaque, the presence of which can contribute to dental caries.[7,8] Mechanically cleaning away plaque every day, including using antimicrobial agents, is a practical and effective way to improve oral hygiene in the long run. This requires patient motivation, education and instruction, followed by encouragement and reinforcement.[10-12] Motivating patients requires both patient

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commitment to adopting new habits in terms of daily plaque control and regular visits to the dentist.[13]

A World Health Organisation report revealed that patients' average adherence to long-term therapy against chronic disease is still low in developing countries. Compliance is a multidimensional phenomenon determined by five interconnected dimensions—patient factors, therapeutic factors, health system factors, environmental factors and socioeconomic factors.[14-17]

Boyd evaluated the effectiveness of disclosing solutions compared with only giving instructions on plaque control. Huber found that professional prophylaxis with accompanying instructions had a significant effect in reducing gingival enlargement associated with a fixed orthodontic appliance.[2,18] An oral hygiene program developed by Yeung resulted in a significant decrease in bleeding on probing (BOP), the gingival index (GI) and the plaque index (PI). McGlynn found no significant difference between a group that received oral hygiene booklets and a group that received oral hygiene lectures. Lee et al compared written, verbal and video methods and found no significant difference between the three methods.[2.18] Brushing is important in achieving good oral hygiene. According to the Bass brushing technique, the toothbrush should be placed horizontally at a 45° angle to the bracket to avoid bracket removal by high force tooth brushing. Brushing should last 30 seconds and should be repeated on the entire tooth surface, especially on the posterior maxillary tooth.[12,19,20]

Several indicators or parameters to assess the oral hygiene of orthodontic patients have been developed and used in epidemiological studies. These include the modified GI and the modified PI for patients with braces.[9] In the present study, the aim was to determine the most effective motivation method to improve the oral hygiene of patients treated with fixed orthodontic appliances in a Jakarta population.

Materials and methods

The study design is a single-blind randomized clinical trial (RCT) with concealed allocation. The study population comprised patients who came to the Orthodontic Clinic at the Oral and Dental Hospital Faculty of Dentistry at Universitas Indonesia during the period 2011–2012. The inclusion criteria were that subjects had to: 1) be patients with fixed orthodontics using standard Edgewise or MBT prescription metal brackets, 2) be treated at this hospital, with the treatment period lasting under one year; 3) have no systemic disease; 4) have no antibiotics within the past two months; 5) be 15–35 years old; and 6) be willing to follow the entire research.

The Oral Hygiene Index scores of patients were collected prior to and after oral hygiene motivation. The subjects were randomly divided into three groups using a single-blind, concealed allocation method. The Oral Hygiene Index score consisting of the modified PI score and the modified GI score was determined for each patient. These scores were recorded as the initial oral hygiene scores of the subjects. The first group was given motivation in the form of dental cleaning instructions via a demonstration using a dental phantom with braces. The second group was given motivation in the form of a cataloguecontaining written instructions and illustrations on how orthodontic patients can clean their teeth properly. The third group was given motivation in the form of teeth cleaning instructions via a video. One month later, the changes in the oral hygiene scores were measured.

Greene and Vermillion (1960)'s PI was used to assess the lower right canine, the lower left central incisors and the lower left first or second premolars by making an imaginary line to divide the tooth surface into vertical and horizontal thirds using the bracket as the centre point. Plaque on five boxes along the edge and under the bracket was assessed (0=no plaque, 1=plaque presence). The total score was 15 (Figure 1). Loe and Silness (1963)'s GI was also employed, with scores ranging from 0–3 (0=absence of inflammation; 1=mild inflammation with gingival colour slightly altered and mild swelling but no BOP; 2=moderate inflammation with reddish gingiva, swelling, shiny appearance and BOP; and 3=severe inflammation with red gingiva, swelling, ulceration and a tendency for spontaneous bleeding). We assessed the lower right canine, the lower left central incisors and the lower left first or second

premolars (the mesio-buccal, mid-buccal and bucco-distal areas). The total score for the whole 3 areas of a tooth was 9, and the overall total score for each subject (3 teeth per subject) was 27.[12]

Statistical data was analysed using SPSS 17.0 to determine distribution frequency, and hypothesis test by using a paired t test (parametric) or a Wilcoxon test (non-parametric). Normality tests in the form of one-way ANOVAs and post hoc Bonferroni tests were also carried out, as were Kruskal–Wallis tests and Mann–Whitney post hoc tests.[21-24]

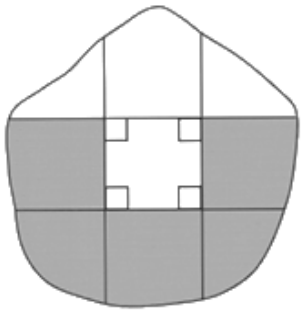

Figure 1. The imaginary line that divides the tooth into vertical and horizontal thirds with the bracket as the centre.[9]

Results

The subjects were randomly divided into three groups using the sealed envelope method. Next, the initial PI and GI scores were determined. Sample groups were then assigned a motivation method Each sample group was given a set of dental-cleaning tools consisting of regular and orthodontic toothbrushes, an interdental toothbrush, dental floss, a floss threader, a mouth mirror and a 2-min timer in the form of an hourglass to ensure the same brushing duration and to eliminate the bias that can occur due to differences in brushing time. For the modelling group, the researchers gave cleaning instructions by using dental phantom with braces, and then the subjects applied the tooth brushing knowledge under the supervision of the researcher. For the catalogue group, the subjects were given time to read the catalogue and then apply the information under the supervision of the researcher. Each subject is this group received a catalogue to take home. For the video group, the subjects were given time to watch the video on an iPod, and then they applied the knowledge under the supervision of the researcher. Each subject is this group was given the video in the form of a DVD to take home. After 4 weeks, all subjects returned to determine their final PI and GI scores.

Table 1 shows the subjects' distribution according to age and gender. A one-way ANOVA revealed no statistically significant difference in terms of mean age between groups. A chi-squared test revealed no statistically significant difference in terms of gender between groups.

	Modelling method	Catalogue method	Video method
Age (years)	23.3±5.6	22.0±3.3	23.0±5.1
Male	3	8	5
Female	17	12	15

Table 1. Research subjects' distribution according to age and gender.

Gingival score for the modelling, catalogue and video groups

Table 2 shows the mean initial GI score of 8.35±3.85 and the mean final GI score of 4.2±2.54 for the modelling group. The score change was 4.15±3.13, with a percentage value of 48.62±23.67%. The paired t-test with a p value of <0.001 indicated a statistically significant difference in the GI score before and after motivation via modelling.

The mean initial GI score for the catalogue group was 7.15±4.23, and the mean final GI score was 3.80±2.56. The score change (delta gingival) was 3.35±3.45, with a percentage value of 36.92±42.79%. A Wilcoxon test with a p value of <0.001 indicated a statistically significant difference in the GI score before and after motivation via the booklet.

The mean initial GI score for the video group was 8.05±3.79, and the mean final GI score was 2.60±1.87. The score change (delta gingival) before and after the video motivation was 3.25±2.31, with a percentage value of 68.31±19%. A Wilcoxon test with a p value of <0.001 indicated a statistically significant difference in the GI score before and after motivation via video.

Comparison of gingival scores between the three groups

Table 2 shows the mean difference in GI scores for each group based on a one-way ANOVA with a p value of 0.611. There was no significant difference between groups in terms of the initial GI score. The final GI score was determined using a Kruskal–Wallis test with a p value of 0.114. There was no significant difference between groups in terms of the final GI score.

Regarding the GI score change (delta gingiva) between groups, a Kruskal–Wallis test with a p value of 0.60 indicated no significant difference. However, if the change is looked at in terms of a percentage, the Kruskal–Wallis test with a p value of .005 indicated a significant difference between groups. A Mann–Whitney post hoc test to determine which groups had significant differences was conducted. This test to determine the gingival delta percentage had the following results: modelling group vs. Catalogue group, *P*=0.765; modelling group vs. video group, *P*=0.006; and catalogue group vs. video group, *P*=0.004. Based on these results, could be seen that groups had significant differences were in the group the modelling group vs. the video group and in the catalogue group vs. the video group (Figure 2). Therefore, the hypothesis that the oral hygiene index score after the video motivation method would be lower than that after the modelling method is accepted. The post hoc results show no significant difference between the modelling and catalogue groups. Therefore, the hypothesis that the oral hygiene index score after the catalogue motivation method would be lower than that after the modelling method is rejected. The results of the post hoc test between catalogue method of vs. video showed no significant difference. Therefore, the hypothesis that the oral hygiene index score after the video motivation method would be lower than that after the catalogue method is accepted.

Plaque score for the modelling, catalogueand video groups

Table 3 shows the mean difference in plaque scores before and after the three motivational methods. The average value of the initial PI score for the modelling group was 9.65±1.69, and the mean value of the final PI score was 6.40± .93. The score change in the modelling group was 3.25±2.31, with a percentage value of 32.29±22.61%. A paired t-test with a p value of <0.001 indicated a statistically significant difference in PI scores before and after the modelling motivation.

The mean value of the initial PI score for the catalogue group was 10.70±2.59, and the mean value of the final PI score was 5.55±2.92. The score change (delta gingival) for the catalogue group was 5.15± .13, with a percentage value of 47.61±25.64%. A Wilcoxon test with a p value of <0.001 indicated a statistically significant difference in PI scores before and after the catalogue motivation.

The mean value of the initial PI score for the video group was 9.20±3.05, and the mean value of the final PI score was 3.50±1.67.

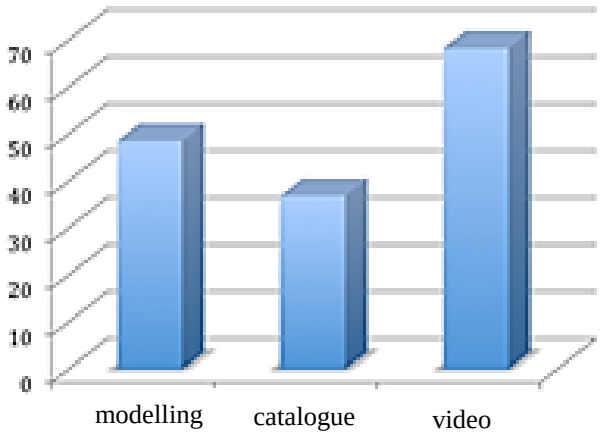

Figure 2. Gingival score changes (Delta in percentage).

The score change (delta plaque) before and after video motivation was 5.70±3.35, with percentage value of 40.22±104.94%. A Wilcoxon test with a p value of <0.001 indicated a statistically significant difference in PI scores before and after the video motivation.

Comparison of plaque scores between the three groups

A Kruskal–Wallis test with a p value=0.158 indicated no significant difference between groups in terms of the initial PI score. A Kruskal–Wallis test with a p value of <0.001 indicated a significant difference between the

groups in terms of the final PI score. A Mann–Whitney post hoc test to determine the difference in final PI scores was conducted. This test had the following results: modelling group vs. Catalogue group, *P*=0.413; modelling group vs. video group, *P*<0.001; and catalogue group vs. video group, *P*=0.030. These results indicate a significant difference in the modelling group vs. the video group and in the catalogue group vs. the video group.

A Kruskal–Wallis test with a p value=0.033 indicated a statistically significant difference between the groups in terms of the PI score change (delta plaque). A Mann–Whitney post hoc test to determine which groups had significant differences had the following results: modelling group vs. Catalogue group, *P* =0.112; modelling group vs. video group, *P* =0.009; and catalogue group vs. video group, *P*=0.376. These results show there was a significant difference between the modelling and video groups. However, if the change is looked at in terms of a percentage, the Kruskal–Wallis test with a p value=0.001 indicates a significant difference between each group. A Mann–Whitney post hoc test for percentage delta plaque had the following results: modelling group vs. Catalogue group, *P*=0.126; modelling group vs. video group, *P*<0.001; and catalogue group vs. video group, *P*=0.162. These results indicate a significant difference between the modelling and video groups (Figure 3).

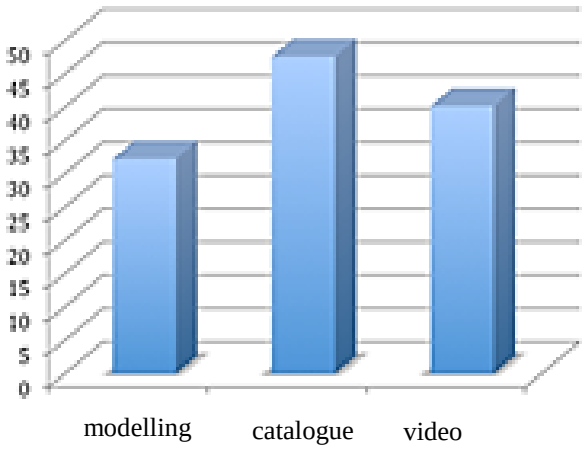

Figure 3. Plaque score changes (Delta in percentage).

Discussion

This study found no statistically significant difference between the three motivation groups in terms of mean PI score at the beginning of data collection. This might be due to homogeneity of the subjects, who had been wearing a bracket for under one year and who had previous knowledge of oral hygiene.

The study results show a significant decrease in PI and GI scores before and after motivation for the modelling and catalogue groups. This is in agreement with Yetkin et al., who found a significant decrease in plaque scores for modelling and cataloguing groups.[18] The video group showed a significant decrease in PI and GI scores, which contradicts the findings of the Lee et al. study, in which there was no significant difference in plaque scores before and after video motivation. However, the p value in the Lee et al. study approached significance value. In addition, the psychosocial, cultural and dietary aspects of the subject population in these two studies were different, which could lead to differences in plaque formation.

The decrease scores in the three methods of motivation in this study is likely a useful methods. In their longitudinal study, Gastel et al. concluded that wearing fixed orthodontic appliances had an adverse impact to microbial agents and clinical periodontal tissue conditions. Such situations should return to normal three months after the fixed orthodontic appliance has been removed.[25] This suggests that motivation to maintain oral hygiene is critical during orthodontic treatment. There was a significant difference in absolute plaque scores among the three motivational groups, with the most significant difference occurring between the video and modelling groups, followed by the video and catalogue groups. This may be because the video motivation was easier and more convenient for patients, the material was presented more clearly and accurately and the patients had the opportunity to learn in private at their own pace.[9] The more the five senses are involved in a learning process, the better the material will be absorbed.

In their literature review, Nielsen and Sheppard found that the use of video as a learning medium can improve a subject's

knowledge and ability and can change his/her behaviour. In the present study, the behavioural changesof the subjects in terms of increased dental hygiene was reflected by the change in PI and GI scores. Machen and Johnson and Fields and Pinkham (cit. Lees 2000) found that video use changed the dental care behaviour of paediatric patients. [9]

This study differs from the study by Nassar et al. They conducted a longitudinal study on 30 patients between 14 and 22 who wore fixed orthodontic appliances. After basic periodontal treatment, the PI and GI scores were evaluated. The subjects were divided into three groups based on three teeth brushing methods—the scrubbing technique, the modified Stillman technique and the Bass technique. The patients were evaluated for 9 months. The conclusion was that the Bass technique was the best method to improve clinical periodontal parameters in patients with fixed orthodontic appliances.[19]

Acharya et al. studied 62 adolescents who underwent multi bracket appliance treatment and evaluated the efficacy of three different motivational techniques to control their oral hygiene and gingival health. The conclusion was the tooth brushing method involving horizontal scrubbing had long-term positive effects compared to other conventional methods of plaque control. [26]

According to Yoder (cit. Lees, 2000), there is no one method of instruction that suits everyone. Each individual is unique and has their own way of learning. [9] Some people may be successful with the modelling method, whereas others may succeed using the catalogue method or the video method. Each method has its advantages and disadvantages. In the modelling method, the demonstration was done directly in front of the subjects. It is inexpensive and easy to do. However, the drawback is that the procedure cannot be easily repeated by the subjects because they have to rely on their memory, which might be faulty. This method can also be tiring for the operators who provide repeated instructions to different subjects, and the information might differ from subject to subject as there is no standard regarding the sentences spoken by the operator. With the catalogue method, the subjects can easily receive information and read it anywhere at any time, and the cost of making the catalogue is quite affordable. However, the information and images are two-dimensional and immovable so that the subjects' understanding might differ from the intent. The words used should be short and clear so as not to confuse the patient. In the video method, the main advantage is that the video can be played innumerable times. A disadvantage is that the video is not playable anywhere because it requires the tool to play the video. However, today's video-making technology has evolved, and the video can be formatted for use on mobile phones so that patients can view the video at any time. However, the cost of making a video is more expensive than the catalogue and modelling methods. Yet, in terms of long-term use, the video method is more effective and efficient than the other methods.

Although in this study the video method resulted in the most significant change, all three motivation methods resulted in a significant decrease in PI and GI scores. This may be because the three motivation methods were performed under the supervision of the researcher. The subjects brushed their teeth according to the instructions contained in the three methods. During sampling, the researchers used a red solution to visualize the plaque on the subjects' teeth. The subjects saw the results in a mirror, which attracted their attention. Thus, the subjects became fully aware of how clean their teeth were and were motivated to pay more attention to oral hygiene.

Conclusions

Three methods of oral hygiene motivation were examined, each having its own advantages and disadvantages. The modelling method whereby a demonstration is conducted directly in front of the subjects is inexpensive and easy to do. However, the disadvantage is that the procedure cannot be properly reproduced by the subjects because they have to rely on their memory, which might be faulty. The method of using written instructions and illustrations in a catalogue that could be read anywhere and anytime is quite affordable. However, the disadvantage is that the information and images are two-dimensional and stationary so that the subjects' understanding might differ from the intent of the instructions. The method of using a video is

easy and more convenient for patients, and the material can be presented more clearly and accurately and can be easily repeated many times. This method involves many of the senses in the learning process, making it easier for subjects to absorb and retain the information and to make proper cleaning a habit.

Based on PI and GI scores, the most effective method for improving patient motivation to maintain good oral hygiene is the video method. This suggests that cooperation between the orthodontist, the patients and the parents is essential.

References

1. Ward OC. John Langdon Down: The Man and the Message. Down Syndr Res Pract. 1999;6(1):19–24.
2. Ruparelia A, Mobley WC. Down Syndrome: A Model for Chromosome Abnormalities. In: Neurobiology of brain disorders. 1st ed. London: Elsevier Inc. 2009:59–76.
3. Kawanto FH, Hendarto A. Factors associated with intelligence in young children with Down syndrome. Paediatr Indones. 2012;52(4):194–9.
4. Alper Avci, Refik Ulku, Serdar Onat. Chylothorax with Down Syndrome: Unusual Case Report. J Int Dent Med Res 2009; 2(1):25-7.
5. Glivetic T, Rodin U, Milosevic M, Mayer D, Filipovic-Grcic B, Saric MS. Prevalence, prenatal screening and neonatal features in children with Down syndrome: A registry-based national study. Ital J Pediatr 2015;41(81):1–7.
6. Bauer D, Evans CA, Begole EA, Salzmann L. Severity of occlusal disharmonies in Down syndrome. Int J Dent 2012;2012:1–6.
7. Al-Otaibi SM, Rizk H, Riyaz MA. Prevalence of dental caries, salivary Streptococcus Mutants, Lactobacilli count, pH level and buffering capacity among children with Down's syndrome in Al- Qassim region, KSA. Int J Contemp Med Res 2016;3(9):2793– 7.
8. Evans-Martin FF. Genes & Disease Down Syndrome. 4th ed. New York: Chelsea House Publishers; 2009.
9. Parks PJ. Down Syndrome.1st ed. San Diego: Reference Press Inc; 2009.
10. Dean JA, Avery DR, McDonald RE. McDonald and Avery's Dentistry for the Child and Adolescent. 9th ed. Philadelphia: Mosby Elsevier Inc. 2011.
11. Peedikayil FC. Delayed tooth eruption. e-Journal Dent. 2011;1(4):81–6.
12. Wang Y, Zhao Y, Ge L. Delayed eruption of permanent teeth in an adolescent with Down's syndrome : A case report. J Med Cases. 2015;6(6):277–8.
13. Moraes MEL de, Moraes LC de, Dotto GN, Dotto PP, Santos LR de A dos. Dental anomalies in patients with Down syndrome. Braz Dent J 2007;18(4):346–50.
14. Ondarza A, Jara L, Munoz P, Blanco R. Sequence of eruption of deciduous dentition in a Chilean Sample with Down syndrome. Archs oral Biol 1997;42(5):401–6.
15. Asokan S, Muthu M, Sivakumar N. Oral findings of Down syndrome children in Chennai city, India. Indian J Dent Res. 2008;19(3):230–5.
16. Cameron AC, Widmer RP. Handbook of Pediatric Dentistry. 4th ed. Philadelphia. Mosby;2013:269–328.
17. K. Kiran Kumar, Nettemu Sunil Kumar, Nettem Sowmya, K. Tanveer, Shameem K, Seetharam Kumar. Pre-Prosthetic Orthodontic Implant Site Preparation For Management Of Congenitally Unerupted Lateral Incisors – A Case Report. J Int Dent Med Res 2013;6: (1):40-4.
18. Bastos JL, Peres MA, Peres KaG, Barros AJD. Infant growth, development and tooth emergence patterns: A longitudinal study from birth to 6 years of age. Arch Oral Biol. 2007;52(6):598–606.
19. Nagy-Bota M-C, Pacurar M, Halmaciu I, Biris C, Pap Z, Brinzaniuc K. Eruption Time of Permanent Teeth in School Children from Targu Mures. Rom J Funct Clin Macro-Microsc Anat Anthropol 2015;14(4):577–83.
20. Almonaitiene R, Balciuniene I, Tutkuviene J. Factors influencing permanent teeth eruption. Part one – general factors. Stomatol Balt Dent Maxillofac J 2010;12(3):67–72.
21. Nelson SJ, Ash MM. Wheeler's Dental Anatomy, Physiology, and Occlusion. 9th ed. Philadelphia: W.B. Saunders. 2010:26– 31.
22. Sjarif W. Deciduous teeth eruption in full and mosaic type of Down's syndrome patient. Dent J (MKG). 2005;38(4):183–4.
23. Khalifa AM. The relationship between gestational age, birth weight, and deciduous tooth eruption. Egypt Pediatr Assoc Gaz. 2014;62(2):41–5.

	Initial Mean Gingival Score (T1)	Final Mean Gingival Score (T2)	Delta Mean Gingival Score (T2-T1)	Delta Mean Gingival Score (percentage)	** p value
Modelling	8.35±3.85	4.2±2.54	-4.15±3.13	-48.62±23.67	p<0.001
Catalogue	7.15±4.23	3.80±2.56	-3.35±3.45	-36.92±42.79	p<0.001
Video	8.05±3.79	2.60±1.87	-3.25±2.314	-68.31±19.00	p<0.001
p* value	0.611	0.114	0.60	0.005	

Table 2. Mean difference in gingival scores for each group (one-way ANOVA)
Mann–Whitney post hoc test for percentage of delta mean gingival score: modelling vs. catalogue, p=0.765; modelling vs. video, p=0.006; cataloguevs. video, p=0.004.
* P values between groups; ** p value between before and after; one-way ANOVA; Kruskal–Wallis test; paired t test; ^ Wilcoxon test. *** p<0: significant difference

	Initial Mean Plaque Score (T1)	Final Mean Plaque Score (T2)	Delta Mean Plaque Score (T2-T1)	Delta Mean Plaque Score (Percentage)	** p value
Modelling	9.65±1.69	6.40±1.93	-3.25±2.31	-32.29±22.61	p<0.001
Catalogue	10.70±2.59	5.55±2.92	-5.15±3.13	-47.61±25.64	p<0.001
Video	9.20±3.05	3.50±1.67	-5.70±3.35	-40.22±104.94	p<0.001
P value	0.158	p<0.001	0.003	0.001	

Table 3. Mean difference in plaque scores before (initial) and after (final) the three motivational methods.

* P between groups; ** p value between before and after; one-way ANOVA; Kruskal–Wallis test; paired t test; Wilcoxon test. Mann–Whitney post hoc test for final plaque differences: modelling vs Catalogue, p=0.413; modelling vs video, p<0.001; cataloguevs video, p=0.030. Mann–Whitney post hoc test for plaque delta: modelling vs Catalogue, p=0.112; modelling vs. video, p= .009; cataloguevs. video, p=0.376. Man–Whitney post hoc test for percent of plaque delta: modelling vs. Cataloguep=0.126; modelling vs. video, p<0.001; cataloguevs. video, p=0.162. *** p<0.05=significant difference.