

Original Article

Computer-Based Oral Hygiene Instruction versus Verbal Method in Fixed Orthodontic Patients

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Abstract

Statement of Problem: Fixed orthodontic appliances in the oral cavity make tooth cleaning procedures more complicated.

Objectives: This study aimed to compare the efficacy of computerized oral hygiene instruction with verbal technique among fixed orthodontic patients referred to the evening clinic of Orthodontics of Shiraz Dental School.

Materials and Methods: A single-blind study was performed in Orthodontic Department of Shiraz, Islamic Republic of Iran, from January to May 2015 following the demonstrated exclusion and inclusion criteria. The sample size was considered 60 patients with 30 subjects in each group. Bleeding on probing and plaque indices and dental knowledge were assessed in the subjects to determine pre-intervention status. A questionnaire was designed for dental knowledge evaluation. The patients were randomly assigned into the computerized and verbal groups. Three weeks after the oral hygiene instruction, indices of bleeding on probing and plaque index and the dental knowledge were evaluated to investigate post-intervention outcome. The two groups were compared by chi-square and student *t* tests. The pre- and post-intervention scores in each group were compared using paired *t*-test.

Results: In the computerized group, the mean score for plaque index and bleeding on probing index was significantly decreased while dental health knowledge was significantly increased after oral hygiene instruction, in contrast to the verbal group.

Conclusions: Within the limitations of the current study, computerized oral hygiene instruction is proposed to be more effective in providing optimal oral health status compared to the conventional method in fixed orthodontic patients.

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Introduction

Presence of fixed orthodontic appliances disturbs the access of oral hygiene instruments to the teeth surfaces and leads to plaque buildup [1,2]. Plaque accumulation on the tooth surfaces is known to cause gingivitis, periodontal loss and enamel demineralization [3,4]. Development of white spot lesions is related to dental plaque around the orthodontic brackets [5,6]. The quality of life of patients with fixed orthodontic appliances will be altered because of the change in their oral health condition [7,8]. Therefore, such patients are normally counseled and treated by hygienists before being placed on the waiting list for receiving their fixed orthodontic treatment. Despite this pre-treatment screening, there is always a reduction in the effectiveness of oral hygiene when the orthodontic treatment phase starts [9].

Oral hygiene is a key factor for preservation of periodontal health as it decreases the microbial plaque that has been accumulated on the teeth and gingiva [10,11]. The effect of patient self-care procedures such as brushing and flossing on prevention of periodontal diseases has been clearly identified [12,13]. Some psychological models to behaviour management for oral hygiene-related behaviours have been demonstrated [14-18]. It is known that applying professional oral health advice on oral hygiene has a great influence on improving the level of oral hygiene of the patients [19,20].

Nowadays, as the technology improves, the use of computers extends, and computers are an inseparable component of an individual's life. A major advantage of computer-based training is its high degree of standardization, repeatability, and clarity. This is what has been called for in research into methods of oral hygiene instruction for a long time [21].

There is some controversy in the reported effects of the computerized oral hygiene instruction compared with conventional methods. In a study conducted on implant patients, a computerized oral health instruction program was compared with conventional oral health instructions. Lower plaque index, pocket depths and bleeding on probing were reported in the computerized group [22]. Another research compared the results of written, verbal and video tape methods of oral hygiene instructions for fixed orthodontic patients. It was declared that there was no significant difference between these methods and all methods had comparable results [23]. A study compared the effect of computer-based oral hygiene

instructions on modified Bass and Fones technique. The computerized oral hygiene instruction was proposed as the most standard technique in teaching both methods of brushing [21].

To the best of our knowledge, there is no research on comparing computerized oral hygiene instruction with other methods such as written or verbal for fixed orthodontic patients. On the other hand, we know that cultural differences can cause different results with each kind of instruction methods. This study aimed to compare the efficacy of computerized instruction with face-to-face verbal techniques among fixed orthodontic patients referring to Department of Orthodontics of Shiraz Dental School.

Materials and Methods

Study Design and Setting

A single-blind clinical trial was performed in the orthodontic specialist clinic of Shiraz Dental School, Shiraz University of Medical Sciences, Shiraz, Islamic Republic of Iran, from January to May 2015. They all underwent their routine orthodontic treatment based on their own orthodontist's recommendation. Their orthodontic treatment was not in any way affected by this study. The selected patients were then divided into two groups based on how they received the oral hygiene instruction.

Subjects, Sample size and Randomization

Fixed orthodontic patients who were admitted in the orthodontic specialist clinic of Shiraz University of Medical Sciences, with no history of previous orthodontic treatment selected using the convenient sampling method by one research assistant. The inclusion and exclusion criteria were: being literate, age range of 13-35, presence of at least 20 of their own teeth, 10 or more teeth showing plaque or bleeding, no study of dentistry, no smoking, no electrical tooth brushing, no dental treatment affecting gingival health or oral hygiene throughout the study, and no pregnancy or lactation during the study. Patients with diabetes, habit of smoking, and local factors predisposing them to plaque accumulation such as faulty restorations, calculus and unusual tooth crown morphology were also excluded. The sample size was considered 60 patients with 30 subjects in each group, based on consultation with a statistician. On the first session of banding and bonding of the lower arch, a self-designed questionnaire, consisting of patients' demographic information, chief complaint and 20

multiple-choice questions, was given to the subjects to assess their knowledge of dental health as a pre-intervention test score.

Validity and reliability of the questionnaire were assessed in a pilot study. First, two faculty members of Shiraz School of Dentistry, one from Department of Orthodontics and one from Department of Periodontics were asked to evaluate each question and the questionnaire as a whole. Revisions were made based on what these two experts found necessary to achieve the main objectives of this study. In the next step of the pilot study, a professional Farsi Language editor was asked to determine the readability of the questions, so that they would be suitable for the patients in this study, considering that the sample could contain teenagers and young adults with minimum literacy. The face validity of the questionnaire was assessed by seeking help from a professional designer. The final questionnaire was distributed among a convenient sample of 20 orthodontic patients. The internal validity was assessed using Cronbach's alpha ($\alpha = 0.73$). These 20 patients were asked to fill the questioner again after four weeks. The test-retest reliability of the questionnaire was assessed using kappa agreement test.

The questions covered knowledge of appliance care and diet and routine dental care during fixed orthodontic therapy. Each correct answer was given 1 score while an incorrect choice was given zero. Therefore, the total score of each patient was in the range of zero to 20. Afterwards, an outline form for recording the oral hygiene condition was filled out by one research assistant as a record of initial oral hygiene status before the intervention. The designed form consisted of patients' demographic information, plaque index and bleeding on probing index. The lower arches of the patients were banded and bonded by one trained technician. Similar brackets, bands [0.022 in, MBT prescription, Mini Master Series™ American Orthodontics™ metal brackets and bands (Sheboygan, WI, USA)], archwire [Nickel Titanium (NiTi) (3M Unitek, Monrovia, California, USA), primer (Ormco, Italy) and adhesive (light cure, Greenglue, Italy) with similar protocol of etching, bonding and curing, were applied in all patients. Brackets and band main tubes were placed on the middle of the tooth occlusogingivally and mesiodistally. Excess adhesive was checked and removed for each tooth. Patients who canceled their appointments, did not agree to participate or debonded their brackets were excluded from the study. After the

completion of pre-intervention form, the patients were randomly divided into two groups: computerized and verbal oral hygiene instruction. The randomization sequence was conducted using a computerized random number generator and the allocation was kept in sealed opaque consecutively numbered envelopes. This simple randomization scheme was independently prepared by a research assistant who was not involved in determining eligibility, providing the dental knowledge questionnaire and oral hygiene assessment form, or evaluating the outcome. After the randomized allocation, the two groups were checked regarding the matching of the probable confounding factors of age and gender.

Oral Hygiene Instruction

The oral hygiene instruction was performed at the end of the session of banding and bonding of the lower teeth. The oral care equipment specialized for orthodontic patients (Sunstar GUM, USA) were prescribed for all the subjects at the session of admission. The patients were asked to bring their equipment at the session of impression taking. Session of banding and bonding was not planned for the patients unless their equipment was checked. The content of the oral hygiene instruction of both groups was similar, consisting of five sections: brushing; flossing using interdental brush; oral rinse; fixed appliance care; and diet. Modified Bass brushing technique was instructed focusing on cleaning the gingival 3rd and the whole braces. Flossing using superfloss was demonstrated and prescribed once daily. Fluoridated oral rinse was introduced for daily use. The appliance care and diet excluding hard foods and sticky chocolates were also explained to the patients. The duration of instruction for both groups was set 10 minutes: 3 minutes for brushing, 1 minute for oral rinse, and 2 minutes for each section of flossing, interdental brush, and appliance care and diet. The prepared instruction was mainly derived from the website of Iranian Association of Orthodontists [24], the website of American Association of Orthodontists [25], the website of British Dental Health foundation [26], and the textbook of Carranza's clinical periodontology [27]. The validity of oral and computerized instruction was checked by two faculty members in each field of orthodontics and periodontics.

The patients in the verbal group received an instruction of oral hygiene procedures verbally by a trained dental student. All the instructions were shown on a dental model with braces. During the

demonstration, the patients were not allowed to ask questions irrelevant to the content of the oral hygiene instruction. This was considered in order to minimize the different information the verbal group might get, compared with the computerized group.

The computerized group received the same information by software. The software was designed by an orthodontist who was a faculty member of Shiraz University of Medical Sciences ("Educational Dental Disc, Orthodontics", Jahan Pardaz Teb Company, Tehran, Iran). The software had the autorun ability and its window opened when the CD-ROM was inserted. The subjects were allowed to use the software only in the clinic. Each section had Farsi written and graphic demonstrations and ended with a training video clip. The narrator of the videos also spoke in Farsi. A section was opened by choosing it from the menu at the bottom of the software window.

After three weeks, the oral hygiene status was evaluated by another research assistant who was unaware of the study protocol to determine the post-intervention condition. The questionnaire of dental knowledge was filled out by the patients once again, the score of which was considered as the post-intervention grade. Patients who did not attend on the due date were excluded.

Outcome measures

The primary outcome was a change in the oral hygiene procedures both theoretically and practically which was determined by the post-intervention score of dental knowledge questionnaire and the illustrated plaque index. The lower arch (the arch to be banded and bonded) was assumed to be comprised of three segments: the segment distal to the right cuspid, that distal to the left cuspid, and that mesial to the right and left first bicuspid. Each segment was examined for debris or calculus. From each segment, one tooth with the greatest area covered by dental plaque was chosen for calculating the individual index, for that particular segment. Buccal and labial surface of each tooth was divided into nine segments using two imaginary horizontal and vertical lines that trisected the tooth surface occlusogingivally and mesiodistally, respectively [23]. The subjects were asked to chew one tablet of a disclosing agent (GUM Red Cote Disclosing Tablets 824 Sunstar Butler GUM, Chicago, USA) and swish around the mouth for 30 seconds without swallowing, expel, and rinse with water for one minute. Of the tooth surface, the gingival two third excluding the middle segment

of the total of nine which is the position of bracket placement or band tube was considered for plaque evaluation. One point would be attributed to each segment of a tooth which was covered with dental plaques. For the assessed individual tooth, the points were added together. The total score for the arch was also determined by adding up the individual scores of the three selected teeth. Therefore, the score range for each individual tooth and the lower arch were 0-5 and 0-15, respectively. The pre-intervention plaque index was measured before banding and bonding of the brackets.

The secondary outcome was presumed to be a change in periodontal health which was measured by the bleeding on probing (BOP) index. The buccal and labial surfaces of each selected tooth for plaque index assessment were also tested for BOP index. Using the same imaginary vertical lines, the BOP was evaluated in three mesial, middle and distal areas of the free gingiva. For each area, one point was considered if bleeding occurred between 30 seconds after gentle probing with a periodontal probe (Williams periodontal probe; Hu-Friedy, Chicago, USA). The sum of the points was regarded as the individual score of the selected teeth for BOP. These scores were added to comprise the total score of the arch. Conclusively, the range of BOP index of each tooth and the whole arch was 0-3 and 0-9, respectively. The pre-intervention BOP index was measured before banding and bonding of the brackets.

Ethical Consideration

Ethical approval was obtained from the Ethics Committee of Shiraz University of Medical Sciences (#94-01-37-9831). The study was in accordance with Helsinki Declaration of 1975 as revised in 2000 [28]. All participants were assured that their data would be kept confidential. All patients' parents signed a written informed consent about letting their data to be used in this study.

Statistical Analysis

The mean of the lower arch score of the plaque index and BOP index for the computerized and verbal groups was calculated. The mean of pre- and post-intervention score for the two groups was also determined. Data were analyzed through SPSS software (SPSS Software, Version 18.0; IBM, Chicago, IL). Matching of the age and gender among the two groups was checked using Student's *t* and Chi-square test. The pre- and post-intervention score

Table 1: The descriptive statistics of the samples

Group	Female (%)	Male (%)	Age Range (Mean ± SD)	Aesthetic Chief Complaint	Functional Chief Complaint	P value
Verbal	24(80%)	6(20%)	13-31(23.7 ± 6.1)	26(86.7%)	4(13.3%)	>0.05
Computerized	25(83.3%)	5(16.7%)	13-31(21.6 ± 6.0)	24(80%)	6(20%)	
Total	49(81.67%)	11(18.33%)	13-31(22.7 ± 6.1)	50(83.3%)	10(16.7%)	

in each group was compared using Paired *t*-tests. The comparison between plaque and BOP index before and after the intervention in each group was also done using the same statistical test.

Results

Sixty subjects consisting of 49 females (81.67%) and 11 males (18.33%) were selected. After randomized allocation, 30 patients were allocated to each of the verbal and computerized groups. None of the subjects cancelled the second visit or debonded their brackets and the recruitment rate of both groups was 100%. The age and gender were matched between the two groups ($p > 0.05$). The descriptive data of the subjects in the verbal and computerized groups is shown in Table 1.

The mean score of plaque index, BOP index and dental health knowledge was not significantly different between the verbal and computerized groups before the oral hygiene instruction ($p = 0.85, 0.54, 0.71$) respectively.

After oral hygiene instruction, the mean score of plaque index, BOP index and dental health knowledge in the verbal group was slightly improved but not significantly different compared with the pre-intervention score ($p = 0.066, 0.161, 0.057$) respectively.

In the computerized group, the mean score for plaque index and BOP index was significantly decreased ($p = 0.037, 0.035$) respectively while dental health knowledge was significantly increased after the oral hygiene instruction ($p = 0.046$) (Figure 1).

Discussion

This study aimed to compare the efficacy of the verbal and computerized oral hygiene instruction among fixed orthodontic patients using plaque index, bleeding on probing index, and dental knowledge score. Oral hygiene can be considered as a behaviour which needs to be learned through oral hygiene instruction to improve the patients' oral health. Some psychological models to behaviour management for oral hygiene-related behaviours have been demonstrated [14-18]. When reviewing these models, some socio-psychological determinants of oral hygiene behaviour were proposed, most of which cannot be controlled. To put it simply, three domains of learning have been demonstrated in the process of behavioural change: cognitive, affective and behavioural [29]. The designed questionnaire for knowledge of dental health was used to evaluate the effect of oral hygiene instruction (OHI) on the cognitive domain. Plaque index was used as a

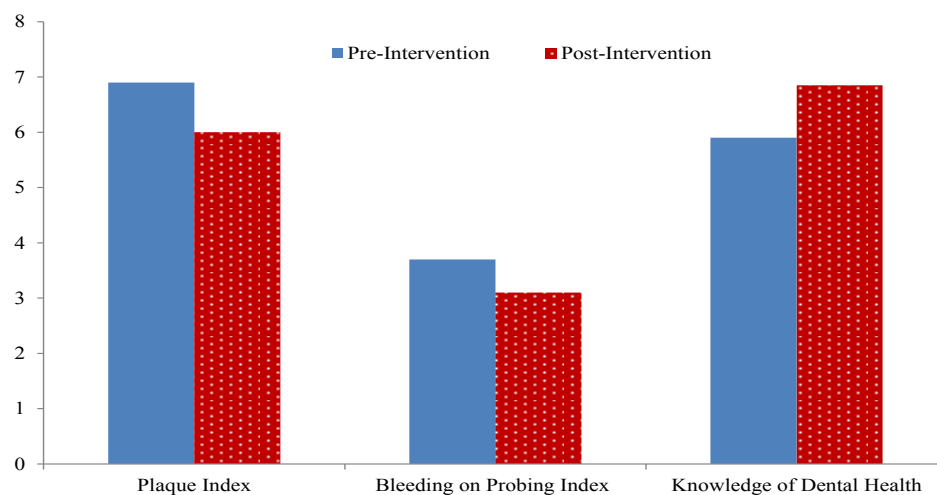


Figure 1: The mean score of plaque index, bleeding on probing index and dental health knowledge before and after computerized oral hygiene instruction

measure of the patient's oral hygiene status and identification of the effect of OHI on the behavioural domain. BOP index was used to assess the condition of the periodontal health which was considered to be the consequence of behavioural change.

The groups were examined to be matched regarding the primary plaque index, BOP index and dental health knowledge, in order to exclude the confounding effects on the result. The dental knowledge, status of oral hygiene and periodontal health were found not to be different between the participants of the two groups. As lifestyle, occupational status and gender are also confounding factors that can affect oral hygiene behaviour [30], they were also taken into consideration. The groups were matched considering the gender and age.

Three weeks after verbal oral hygiene instruction on the session of banding and bonding the lower arch, dental health knowledge and the status of oral hygiene and periodontal health did not change significantly. Regarding the two indices, it can be concluded that the verbal OHI was effective as the oral hygiene and periodontal health was expected to be worse if special oral hygiene procedures were not applied. Besides, considering the *p* values of the three parameters (*p* plaque index = 0.066, *p* BOP index = 0.161, *p* test = 0.057), it can be inferred that if the number of participants was higher in this group, the results would probably be statistically significant.

In the computerized OHI group, dental health knowledge and the condition of oral hygiene and periodontal health were improved significantly. Viewing the similar number of subjects in the verbal and computerized groups, it can be suggested that the computerized OHI is possibly more effective for fixed orthodontic patients within the age range of 13-31 years.

Since the orthodontic brackets and wire would disturb the cleansing procedures in the gingival two thirds, only these areas were evaluated for plaque index assessment, excluding the area of the bracket placement as in Less and Rock' study [23].

Sano and colleagues [22], comparing a computerized program with conventional oral hygiene instruction on implant patients, found that patients who used the computerized oral health instruction had lower plaque index, pocket depths and BOP; they concluded that the instruction program made it easier for the patients to understand their oral condition, and to learn and repeat appropriate self-care practices. The result of the plaque index and BOP index was in

agreement with the current study. In Sano's study, the oral hygiene index (OHI) was used rather than plaque index [22]. Oral hygiene index includes combined debris and calculus index. Confounding factors were not noted in sample selection or randomization, in contrast to our study in which they were mentioned as the exclusion criteria. The subjects were allowed to take the designed CD-ROM home. This might cause some interaction of the information in the CD-ROM between the two groups which may make the trial uncontrolled and the deductions cannot be relied on. There was control neither over the number of CD-ROM viewed by the subjects, nor the exchange of the CD-ROM between the verbal and the computerized groups. Besides, if the computerized OHI can be helpful only in the office, it will be of great value and will save money and time for the patients.

Less and Rock, comparing the results between written, verbal and video tape methods of oral hygiene instructions for fixed orthodontic patients, concluded that there was no significant difference between these methods and all methods had comparable results [23]. This was in contrast to our results. The reason of this difference might be the fact that the patients participating in the study were banded and bonded during one to three previous months. It was not exactly stated when the patients were instructed how to clean their teeth and braces or if they were instructed with the same technique. This was probably a confounding factor in the study. If the subjects were not instructed in the first session of banding and bonding, it would be unethical.

Comparing the effect of computer-based oral hygiene instructions on modified bass and Fones technique on students, Harnake and co-workers concluded that computerized oral hygiene instruction is proposed as the most standard technique in teaching methods of brushing. Fones technique was concluded to be more advantageous than modified Bass technique [21]. Papillary bleeding index and Turesky modification of the plaque index of Quigley and Hein were assessed six, twelve, and twenty eight weeks after the visit of oral hygiene instruction. The subjects were students probably in similar age group of young adults; this was not stated clearly in the method or results of the research. In our study, the subjects were adolescents and young adults (13-31 years).

Our study had some limitations. In female subjects, the effect of menstrual cycle and hormonal changes could not be matched between the two groups. This

might have confounded the result of the research. Moreover, the status of oral hygiene was evaluated only after three weeks and the maintenance of the oral hygiene behaviour was not assessed in further follow ups. Future studies with more follow ups and higher sample volume are suggested to be conducted.

Conclusions

Within the limitations of the current study, computerized oral hygiene instruction was suggested to be more effective in providing optimum oral health status compared to conventional method in fixed orthodontic patients.

Conflict of Interest: None declared.

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