Original Article

Oral Health Related Quality of Life Assessment in Orthodontic Patients with Anchorage Reinforcement

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Abstract

Objectives: To assess oral health related quality of life (OHRQoL) among orthodontic patients who had been allocated into three methods of orthodontic anchorage; transpalatal arch (TPA), modified TPA-Nance (TPA-Nance) and mini-implant (MI).

Materials and Methods: This study was conducted in Faculty of Dentistry, Universiti Teknologi MARA, Sungai Buloh and Puncak Perdana campus. Thirty-six orthodontic patients with anchorage requirement between 18 and 30 years old were recruited. The subjects were equally divided into three groups, which included 28 females and 8 males. The assessment of patients' oral health related quality of life (OHRQoL) towards the anchorage supplementation using modified oral health impact profile (S-OHIP-14) questionnaires were carried out. The questionnaire was given at two time points, which was before the insertion of the allocated anchorage regime (T_0) and after a week of insertion of the allocated anchorage regime (T_1).

Results: There was no statistical significant difference on functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap domains of OHIP-14 questionnaire between the three anchorage groups (p>0.05).

Conclusion: The OHRQoL patterns, during the treatment with the anchorage reinforcement were very similar. This suggests that TPA, TPA-Nance and MI do not affect patients' OHRQoL. The OHRQoL trends observed during the study can be communicated to patients and used to increase patients' compliance since they are made aware of the whole treatment process.

Keywords: mini-implant, modified TPA-Nance, oral health related quality of life (OHRQoL), transpalatal arch.

Abbreviations: ADD (Additive Score); MI (Mini-implant); OHRQoL (Oral Health Related Quality of Life); S-OHIP-14 (Oral Health Impact Profile 14 Questions); SC (Simple Count Score); TPA (Transpalatal Arch); TPA-Nance (Modified TPA-Nance)

Introduction

Orthodontic anchorage can be defined as the resistance to unwanted tooth movement[1]. Anchorage is an important consideration when planning orthodontic tooth movement and the main factors for determining the success of orthodontic treatment[2]. In the earlier years, headgear was widely used as extra-oral anchorage to prevent anchorage loss especially in maximum anchorage requirement cases[3]. However, the use of headgear has been associated with facial injury and depends highly on the patient's compliance[4,5].

Alternatively, intra-oral appliances have been introduced as anchorage reinforcement, such as Nance appliance or

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transpalatal arch appliance and currently, mini-implant. The usage of these anchorage regimes does not depend on the patient's compliance. Despite its advantages, patients could suffer from breakages, peri-implantitis and pain. There is possibility of additional discomfort together with fear and pain resulting from the added surgical procedure or inflammation. This can contribute to the patient avoiding orthodontic treatment. It could change the patients' decision when choosing between mini-implant and other intra/extraoral orthodontic anchorage.

There were various studies had been conducted to assess patients' oral health related quality of life (OHRQoL), acceptance and pain experience with certain type of anchorage regimes, namely headgear, transpalatal arch appliance, Nance appliance and mini-implant[6–9]. However, little evidence is known about the patients' OHRQoL with modification of transpalatal arch in combination with Nance button. Therefore, the aim of this prospective study was to assess the impact of three orthodontic anchorage reinforcement, transpalatal arch (TPA), modified TPA-Nance (TPA-Nance) and mini-implant (MI), on patient's OHRQoL. The knowledge obtained from this study can also educate the patients during informed consent.

Materials and methods

This study was conducted at the postgraduate orthodontic clinic, Faculty of Dentistry, Universiti Teknologi MARA, Sungai Buloh and Puncak Perdana campus. This study was reviewed and approved by the Research Ethics Committee, Universiti Teknologi MARA (reference number: 600-IRMI (5/1/6)). The selection of subjects was based on the inclusion and exclusion criteria.

For the study eligibility, the following inclusion criteria were applied:

i. Age 18 – 30 years old at the start of treatment.

ii. Intra-oral findings, which include:
   a) Overjet 6 mm to 8 mm.
   b) Class II ½ unit or more canine relationship.
   c) Less than Class II ½ unit molar relationship.
   d) Moderate to severe crowding on the upper and lower arches.
   e) Mesially angulated maxillary canines.
   f) Proclined upper incisors.
   g) Upper centreline shift of less than 4 mm.

iii. Orthodontic treatment plan does not require distal movement of maxillary molars.

iv. Orthodontic treatment plan requires extraction of maxillary first premolars and two mandibular premolars.

Exclusion criteria included the presence of poor oral hygiene, had previous orthodontic treatment or extractions, any dental or craniofacial anomalies (such as cleft lip and palate), hypodontia, orthognathic cases, extractions of maxillary first permanent molars, active periodontal disease, allergy towards lignocaine or nickel, crossbite that required correction.

Selected subjects were interviewed and provided with the information about this study. Upon agreement, verbal and written consent were obtained followed by allocations into three groups; 1) TPA,

2) TPA-Nance and 3) MI.

Thirty-six subjects were recruited and they were equally divided into three groups; TPA, TPA-Nance and MI based on the treatment plan that was agreed between the clinician and subject.

For those who received a TPA, molar bands (3M Unitek™ Narrow Contoured Molar Bands, California) were fitted on both the first permanent maxillary molars a week after separation. Upper alginate impression (Kromopan, Lascod, Italy) was taken over the bands and sent to the laboratory for casting and fabrication of the TPA. A technician (SH) was assigned to fabricate the TPA, which was made from a 1.0 mm stainless steel (SS) wire soldered to the palatal surface of molar bands with a U-loop facing posteriorly and it was placed 2.0 mm away from the palatal vault (**Figure 1**). It was cemented using a glass ionomer luting cement (GC Fuji 1, Japan) a week later.

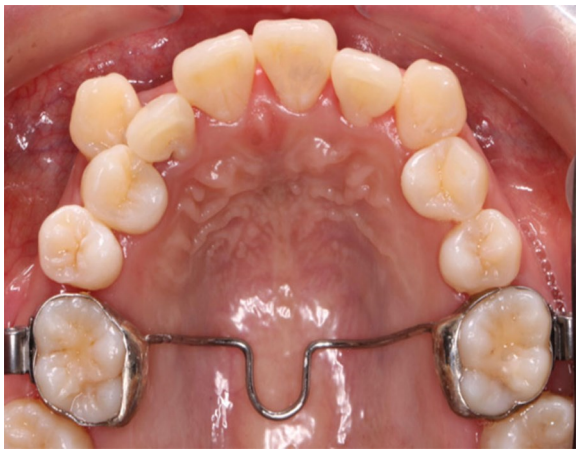

Figure 1: TPA was cemented on the maxillary first permanent molars

Meanwhile, subjects who received a TPA-Nance, the clinical procedures involved were similar to the construction of TPA. However, the laboratory procedures were different, in which the technician (SH) incorporated an acrylic button (Orthoplast Vertex, Netherland) on the anterior palatal vault and soldered together with the 1.0 mm SS wire as the transpalatal arch onto the molar bands (3M Unitek™ Narrow Contoured Molar Bands, California) (**Figure 2**). It was also cemented using the glass ionomer luting cement (GC Fuji 1, Japan) one week later.

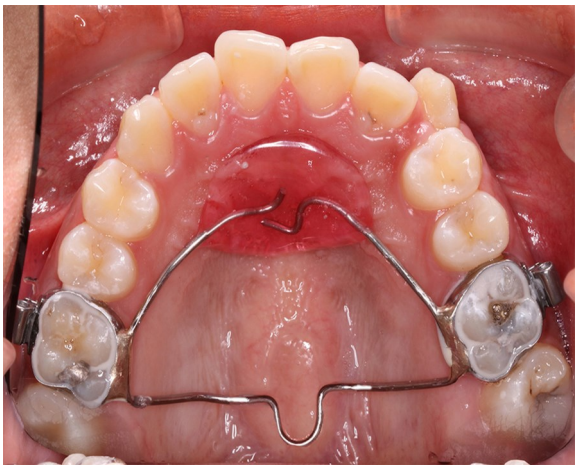

Figure 2: TPA-Nance was cemented on the maxillary first permanent molars

On the other hand, subjects who received a MI, an experienced operator (ZZ) was assigned to place the MI. Prior to insertion, an intra-oral periapical radiograph was taken to assess the interdental space, root angulations and the amount of inter-radicular bone present between the maxillary second premolar and first molar[10]. A guided bar was in place to facilitate MI insertion. Self-drilling titanium MI (1.6 mm diameter and 8 mm length; ORLUS®, Korea) was used. A few drops of local anaesthesia (4% articaine hydrochloride with adrenaline 1:100,000; 1.7 ml, 3M Ubistesin™ forte, Australia) was administered to reduce patient discomfort during the insertion of MI[11]. Then, the MI was inserted between the maxillary second premolar and first molar at the mucogingival junction (**Figure 3**), followed by taking an intra-oral periapical radiograph to confirm the MI position.

Upon insertion of the allocated anchorage regimes, extractions of the maxillary first premolars bilaterally were carried out. All

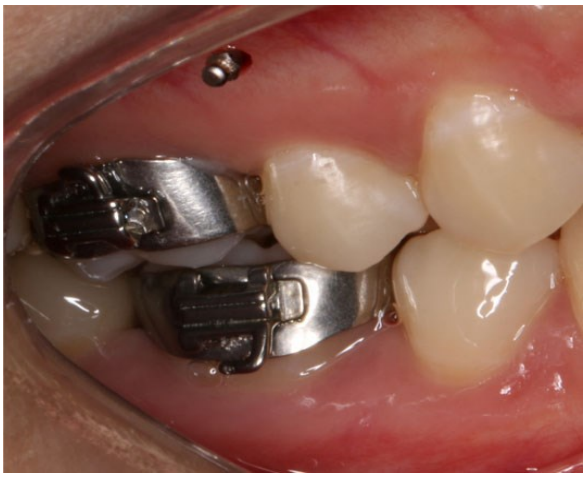

Figure 3: MI was placed at the inter-radicular space between maxillary second premolar and first permanent molar

subjects were treated using a pre-adjusted Edgewise fixed appliance with McLaughlin, Bennett and Trevisi (MBT) prescription on a 0.022" x 0.028" slot metal brackets (3M-Unitek, Monrovia, California).

The OHRQoL was measured with the modified and validated S-OHIP-14 questionnaire (**Table 1**), which was given at two times; before the insertion of allocated anchorage regime, as a baseline (T_0) and a week after the insertion of the allocated anchorage regime (T_1). The S-OHIP-14 questionnaire consists of the following seven domains:

1. Functional limitation
2. Physical pain
3. Psychological discomfort
4. Physical disability
5. Psychological disability
6. Social disability
7. Handicap

Each domain was represented by two questions. The S-OHIP-14 scores follow a Likert-type scale:

Code	Score
Never	0
Hardly ever	1
Occasionally	2
Fairly often	3
Very often	4

There are two different methods to score the S-OHIP-14 questionnaire. First, the “simple count method” (SC) in which the total score is calculated by summing up the number of impacts (answer number 3 and 4) reported more frequently. A negative impact of oral health on an individual’s life is indicated by answers 3 and 4, and a positive impact is indicated by answers 2,1 and 0. The second method is the “additive method” (ADD), in which the total score is calculated by summing up the item codes for the fourteen questions, with the total score ranging from 0 and 56. The higher the value of the score, the worse is the oral health[12].

The data was analysed using Statistical Package for Social Sciences version 21.0 (SPSS; IBM Corporation, Armonk, New York, USA). The comparison between groups was calculated using one-way ANOVA and paired t-test comparing at two times base within group. The level of significant was set at $p<0.05$.

Domain	Questions
a) Functional limitation	1. Have you experience difficulty chewing any food because of problems with your teeth, mouth or anchorage device? 2. Have you felt problems related to your teeth, mouth or anchorage device cause bad breathe?
b) Physical pain	1. Have you experienced discomfort eating any food because of problems with your teeth, mouth or anchorage device? 2. Have you experienced ulcers in your mouth?
c) Psychological discomfort	1. Have you felt discomfort due to food getting stuck in between your teeth or anchorage device? 2. Have you felt shy because of the problems with your teeth, mouth or anchorage device?
d) Physical disability	1. Have you avoided smiling because of problems with your teeth, mouth or anchorage device? 2. Has you concentration been disturbed by problems with your teeth, mouth or anchorage device?
e) Psychological disability	1. Have you avoided going out because of problems with your teeth, mouth or anchorage device? 2. Have you experienced problems in carrying out your daily activities because of problem with your teeth, mouth or anchorage device?
f) Social disability	1. Have you had to spend a lot of money due to problems with your teeth, mouth or anchorage device? 2. Have you felt less confident of yourself due to problems with your teeth, mouth or anchorage device?
g) Handicap	1. Have you avoided eating certain foods because of problems with your teeth, mouth or anchorage device? 2. Have your sleep been disturbed of problems with your teeth, mouth or anchorage device?

Table 1. Modified S-OHIP-14 questionnaires

Results

Thirty-six subjects were recruited and they were equally divided into three groups according to the orthodontic anchorage regime used. All the recruited subjects were adult, which included 8 males and 28 females (**Table 2**).

Total in S-OHIP-14 scores was represented in **Table 3** and changes in S-OHIP-14 domain score between groups were shown in **Table 4**. The difference between T_0 and T_1 for every domain and total in S-OHIP-14 scores was not statistically significant difference except for psychological discomfort domain in MI group.

	TPA	TPA-Nance	MI
Gender			
Male (n)	1	2	5
Female (n)	11	10	7
Age (Years)	24.8 ± 3	23 ± 2.5	22.8 ± 2.8

Values are number of occurrence or mean (standard deviation)

Table 2. Demographic data of the study sample

	Group A		Group B		Group C		*P*-value
	Male	Female	Male	Female	Male	Female	
T_0[a]	38 (0)	35 (14.8)	44 (11.3)	41.6 (14)	29.8 (12.2)	34.7 (9.3)	0.19
T_1[a]	39 (0)	31.5 (12.5)	34.5 (5)	37.6 (7)	26.4 (6.3)	34 (13.4)	0.31
Mean Difference[b]	-1	3.5	9.5	4	3.4	0.7	0.04
***P*-value**	0.8	0.5	0.8	0.5	0.4	0.2	

[a] One-way ANOVA — Significant level set at $p<0.05$

[b] Paired t-test — SC (Simple count method)

Values are mean (standard deviation) — ADD (Additive method)

Table 3. Comparison of total S-OHIP-14 scores (SC and ADD) at T_0 and T_1 between gender among three anchorage groups

Domain	Group	T_0[a]	T_1[a]	Mean difference[b]	*P*-value
Functional limitation	TPA	2.00 (1.44, 3.01)	2.04 (1.54, 2.54)	-0.04	0.88
	TPA-Nance	2.58 (1.97, 3.2)	2.58 (1.97, 3.2)	0.04	0.90
	MI	2.17 (1.51, 2.82)	2.04 (1.67, 2.41)	0.13	0.62
Physical pain	TPA	2.5 (1.99, 3.01)	2.29 (1.88, 2.71)	0.21	0.27
	TPA-Nance	2.63 (1.97, 3.28)	2.83 (2.34, 3.33)	-0.20	0.38
	MI	2.38 (2.07, 2.68)	2.5 (2.07, 2.93)	-0.12	0.61
Psychological discomfort	TPA	2.75 (2.07, 3.43)	2.54 (1.9, 3.18)	0.21	0.40
	TPA-Nance	3.17 (2.62, 3.71)	2.71 (2.29, 3.12)	0.46	0.08
	MI	2.88 (2.4, 3.35)	2.17 (1.48, 2.85)	0.71	0.00
Physical disability	TPA	2.33 (1.64, 3.03)	2.38 (1.67, 3.08)	-0.05	0.88
	TPA-Nance	2.58 (2.0, 3.17)	2.33 (1.82, 2.85)	0.25	0.17
	MI	2.25 (1.73, 2.77)	1.83 (1.15, 2.52)	0.13	0.25
Psychological disability	TPA	2.00 (1.35, 2.65)	1.71 (1.16, 2.26)	0.29	0.21
	TPA-Nance	2.21 (1.54, 2.88)	2.00 (1.77, 2.23)	0.21	0.50
	MI	1.50 (1.03, 1.97)	2.00 (1.52, 2.4)	-0.50	0.09
Social disability	TPA	1.33 (0.92, 1.75)	1.29 (0.9, 1.69)	0.04	0.34
	TPA-Nance	1.71 (1.18, 2.24)	1.38 (1.18, 1.57)	0.33	0.14
	MI	0.96 (0.61, 1.3)	1.13 (0.82, 1.43)	-0.17	0.39

Domain	Group	T_0[a]	T_1[a]	Mean difference[b]	*P*-value
Handicap	TPA	2.08 (1.44, 2.73)	1.88 (1.28, 2.47)	0.20	0.34
	TPA-Nance	2.58 (1.92, 3.24)	2.00 (1.44, 2.56)	0.58	0.10
	MI	2.00 (1.29, 2.63)	1.38 (0.71, 2.04)	0.62	0.06

[a] One-way ANOVA

[b]Paired t-test

Mean (Confidence Interval)

Significant level set at $p<0.05$

Table 4. Comparison of Mean of Each Domain at T_0 and T_1 Between Three Anchorage Groups

Discussion

Orthodontic treatment is often associated with the presence of pain, starting from the separator placement, tooth extraction, placement of anchorage devices, initial alignment stage, space closure phase and up to the finishing stage[13]. Pain and discomfort may affect patient's acceptance and compliance. The probability of patients experiencing pain and discomfort during the orthodontic treatment needs to be acknowledged by the patients and the clinicians.

Previously, there have been many studies assessing patients' discomfort and pain experience after placement of anchorage devices, for instance, HG, TPA, Nance appliance and MI[7,14–16]. In those studies, the methods used to evaluate the discomfort and pain level were VAS score and assortment of questionnaires. Meanwhile, in this study, S-OHIP-14 questionnaire had been used to evaluate patient's acceptance in a wider scope including the psychological evaluation.

In recent years, research regarding gender difference in pain has increased substantially. Women were suggested to report more severe pain, at a higher frequency, and in a greater number of body regions, than man[17–19]. Lack of studies was conducted to correlate between acceptance of anchorage reinforcement with gender. Therefore, the results obtained were incomparable with previous studies. However, there was no statistically significant difference noted between gender and anchorage reinforcement.

The questionnaires were adapted from the previous study[20] and were given before and a week after the allocation of anchorage regimes with the assumption that all the subjects were able to understand the questionnaires. The pain intensity gradually declines over the period of one week and the patients can adapt to the treatment after that[13]. Therefore, the questionnaires were given a week after the insertion of the allocated anchorage regime in order to obtain the subjects' experience and they can still remember the occasion.

Although the S-OHIP-14 results are incomparable with other instruments of pain and discomfort assessment, the conclusion drawn is similar to other studies.

The patients' acceptance towards the TPA usage was in agreement with the previous study[7].

On the other hand, two case reports were published outlining the complications with Nance appliance wear with the presence of necrotizing tissue underneath the acrylic button and swelling around it due to inadequate cleaning[21,22]. However, in this study, there was no complaint or report about the complication in the TPA-Nance group. Patients can adapt well to the TPA-Nance and it did not affect the patient's quality of life even in the presence of an acrylic button on the palatal mucosa.

From the results obtained, there were several domains from different anchorage group that showed an increase in the mean S-OHIP-14 score at T_1 compared to T_0. The lesser score showed good quality of life, however, the higher score showed poor quality of life[20]. Even though there was difference between the T_0 and T_1 score, there was no statistical significant difference between the scores. Nevertheless, it did not give any clinical impact upon receiving the allocated anchorage regime because the difference was not statistically significant.

Apart from that, only one domain in MI group that shows statistical significant difference with a *P*-value of 0.00, however, the score obtained was lower upon receiving the allocated anchorage regime. Therefore, it can be considered that the MI did not affect the subjects' psychological state.

Conclusions

Statistically, the S-OHIP-14 scores showed no significant difference between pre- and post- insertion of allocated anchorage between the three anchorage regimes. Therefore, we can conclude that TPA or TPA-Nance or the MI did not affect patients' quality of life. They were able to perform their daily activities normally, without any adverse effect. The OHRQoL trends observed in this study may be useful during communication with patients and increase their compliance as it will help them understand and be aware of the orthodontic treatment process.

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Conflicts of interest

There are no conflicts of interest.