A preliminary assessment of oral health related quality of life in orthodontics patients with Ss and TiA micro-implant

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Abstract

Objective: *The purpose of this study was to assess Oral Health-Related Quality of Life (OHQoL) among orthodontic patients who have had Stainless steel (Ss) and Titanium-Alloy (TiA) micro-implants.*

Methods: *Sample size of thirty patients, aged between 18-30 years. The patients were divided equally into three groups (control, Ss and TiA). The micro-implants had diameter of 1.6mm and length of 8mm. Randomisation was carried out to determine the type of micro-implant received by treatment group. The oral health quality of life was assessed by using S-OHIP14 (M) Malay version twice; before micro-implant insertion (T_0) and after four weeks micro-implant insertion (T_1).*

Results*: There were significant differences found for physical pain, psychological discomfort and physical disability ($P<0.05$).*

Conclusion: *Orthodontic treatment with micro-implants had significant different of OHQoL in physical pain (TiAvs control) and psychological discomfort (Ssvs control. There was a significant difference between Ss and TiA physical disability at T_1.*

Keywords: micro-implant, oral health related quality of life (OHQoL), orthodontic, temporary anchorage device, stainless steel (Ss), titanium alloy (TiA).

1. Introduction

Micro-implant is acknowledged in orthodontics field as a type of temporary anchorage device that often used in high anchorage demanded case. It has been more than one decade micro-implants being utilized for various clinical purposes. It also represent as an option for noncompliance patient with extra oral anchorage device. Despite its advantages patients could suffer from breakages, peri-implantitis, and pain and these will lead discomfort to the patients(Kuroda, Sugawara, Deguchi, Kyung, Takano-Yamamoto, 2007). These situations usually happen due to multi factorial reasons such as improper position of micro-implants, poor oral hygiene, smoking habit and when the infection occurs.

Somehow not all patients agree and allow the micro-implant to be inserted into their mouth. Further study on oral health related quality of life patients with micro-implant may help in giving an overview to the patients who requires micro-implants. Nowadays, more patients are concern on quality of life with no exception of orthodontics patients. Many studies done on how orthodontics treatment improves patients' quality of life especially patients who undergone orthognathic surgery (Baherimoghaddam, Tabrizi, Naseri, Pouzesh, Oshagh&Torkan 2016; Antaoun, Fowler, Jack, &Farella, 2015).

1.1 Type of micro-implant

Micro-implants can be made of stainless steel alloy, cobalt chrome alloy, commercially pure titanium or titanium alloy (Ti-6Al-4v). Study has shown no significant difference between stainless steel and titanium alloy micro-implant in term of mechanical strength (Carano, Velo, Leone &Siciliani, 2005). Ss micro-implants believed to be cheaper than TiA micro-implants and are easily available in the market. Titanium alloy used is generally grade 4 or 5 and stainless steel has been suggested as alternative (Carano et al, 2005).If it is found to be effective for the purpose stated

above, the clinician will have the option in choosing the micro-implant type depending on the patient's clinical need or financial status.

1.2 Discomfort on micro-implants

Several studies reported on patients discomfort when they received micro-implants. Study shown patients are more comfortable with micro-implant and some even suggested recommending the treatment modality to their friends(Sandler, Murray, Thiruvenkatachari, Gutierrez, Speight,& O'Brien, 2014). Patients do experience swelling, difficulty in speech, pain and having problem with chewing post-operative micro-implants insertion but only for temporary period (Kuroda *et al*, 2007). Patients who had micro-implants also rated dental extraction is more pain than insertion of micro-implants((Baxmann, McDonald, Bourauel&Jager, 2010) but there were patients who needed to take pain medication to relieve the pain(Zawawi, 2014).

1.3 Oral health related quality of life (OHQoL)

Assessment of patient's pain and discomfort is usually done by using questionnaires that are given to patient postoperative micro-implants insertion. Various types of questionnaires were applied in previous studies when assessing patient discomfort. In the present study the oral health related quality of life (OHQoL) was assessed using Short form of Oral Health Impact Profile (S-OHIP) that translated to Malay language for Malaysian adults. The aim of this study was to assess oral health-related quality of life (OHQoL) among orthodontic patients who had received orthodontic micro-implants as part of their orthodontic therapy.

1.4 Aim and Objective

The purpose of this study was to assess Oral Health-Related Quality of Life (OHQoL) among orthodontic patients who have had Stainless steel (Ss) and Titanium-Alloy (TiA) micro-implants.

2. Material and methods

Thirty subjects were selected from the postgraduate orthodontic clinic, Faculty of Dentistry of UniversitiTeknologi MARA, Malaysia. The study consisted of eleven (37%) males and nineteen females (63%), age range between 18 to 30 years. Twenty patients who were eligible for micro-implants as part of orthodontics treatment modality were identified such as high anchorage demanded case and need for en-masse retraction to reduce overjet.

2.1 Oral health impact profile (S-OHIP)

The decision for the group of implant was derived byrandomisation. Another ten patients not needing micro-implants in their treatment were selected for control group. All patient were asked to complete S-OHIP(M) (Saub, Locker, Allison, 2005) form that comprised of fourteen questions which consist of seven domains:

1. Functional limitation
2. Physical Pain
3. Psychological discomfort
4. Physical disability
5. Psychological disability

6. Social disability
7. Handicap

Each domain represented by two questions. The S-OHIP (M) report base on Likert-type scale at 5 points coded and scored as below:

Code	Score
a. Very often	4
b. Fairly often	3
c. Occasionally	2
d. Hardly ever	1
e. Never	0

The calculation of the impact profile on oral health and quality of life is by sum the total scores of all fourteen questions, range from 0 to 56 and for each domain scores range from 0 to 8.

2.2 Time of intervention

Patients were given the questionnaires before micro-implants insertion (T_0) and four weeks after micro-implants insertions (T_1). Before micro-implants insertion selected patients had been explained about the advantages, the risks and the complications of using micro-implants. Patients must medically fit with good oral hygiene.

2.3 Clinical procedure

Titanium alloy micro-implants with diameter of 1.6mm and 8mm in lenght (Orlus Mini Screw 1016108) and Stainless steel micro-implants with similar dimension, diameter of 1.6mm and 8mm in length (DentosMicroimplant SH1615-08) were chosen in this study. After location of micro-implants were identified minimum local analgesia were given before micro-implants insertion and the micro-implants were inserted by using self-tapping method (Figure 1) by a single operator. Peri-apical radiographs were taken to identify position of micro-implants in the inter-radicular space of alveolar bone. Each patient in micro-implants group had two micro-implants inserted at the maxilla, mesial to upper first molars and remained unloading for about four weeks. Patients were recalled for T_1 (4 weeks) and questionnaires given before canine retraction was applied.

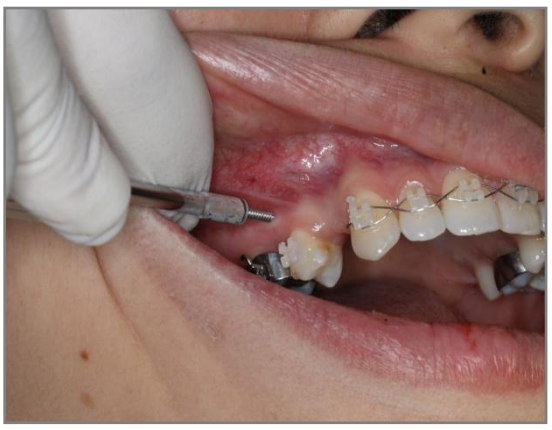

Figure 1.Self-tapping insertion of micro-implant for anterior retraction.

For the control group, the questionnaires given after alignment and levelling phase (T_0) before any active tooth movement applied in the other mean just before 0.019 x 0.025 stainless steel working archwire inserted into bracket slot and after four weeks left in passive (T_1). The aim was to reduce bias as canine retraction or any form of active mechanics will give false reading on questionnaires.

2.4 Data analysis

The data was analysed using Statistical package for Social Sciences version 20 (SPSS; IBM Corporation, Armonk, NY, USA). The comparison between groups was calculated using Kruskal-Wallis test. The level of significant was set at $P<0.05$.

3. Result

3.1 Sample demographic

All patients in both group completed the questionnaires with 100% response rate at two point of time. Mean age for thirty patient for TiA, SS and control group was 22.10 (±2.68), 25.10 (±2.64), 23.50 (±3.06) years respectively (Table 1).Both group had lesser male subjects and female subjects were more than sixty percent.

Table 1. Sample distribution

Variables	**Titanium alloy, n (%)**	**Stainless steel, n (%)**	**Control, n (%)**
Sex			
Male	2 (7.0%)	4 (13.3%)	5 (16.7%)
Female	8 (26.7%)	6 (20.0%)	5 (16.7%)
Age			
years, mean ± SD	22.10 ± 2.68	25.10 ± 2.64	23.50 ± 3.06
Skeletal pattern			
Class I	2 (7.0%)	3 (10.0%)	5 (16.7%)
Class II	8 (26.7%)	7 (23.4%)	5 (16.7%)
Class III	-	-	
Malocclusion			
Class I	2 (7.0%)	1 (3.3%)	2 (7.0%)
Class II Division 1			
Division 2	8 (26.7%)	9 (30.0%)	4 (13.3%)
Class III	-	-	3 (10.0%)
Overjet,	-	-	1 (3.3%)
mean ± SD	7.1 ± 1.97	8.0 ± 1.63	4.4 ± 2.60

SD, Standard deviation

Class II skeletal pattern dominated both micro-implants group however Class II division 1 malocclusion was higher in micro-implants group due to high anchorage demanded cases which consisted of 21 patients. Mean overjet was 7.1± 1.97in TiA micro-implant group, 8.0 ± 1.63 in SS micro-implants group and 4.4± 2.60in control group.

3.2 Changes of OHRQoL

The changes between groups at T_0 and T_1 were analysed by using Kruskal-Wallis test for comparing two or more independent samples of equal or different sample sizes. Changes in OHIP-14 domain score between and within studied groups were showed in Table 2. The differences between groups at T_0 every domain and total OHIP-14 score were not significant. Demonstrating that there was no difference found on all domains between groups at baseline measurement prior to micro-implant insertions on micro-implant groups.

Table 2. Comparison of OHQoL between groups at baseline (T0) and after 4 weeks intervention (T1)

Variables	**Group**	**T^0 Median (IQR)**	***X*² *statistic (df)*** [a]	***p*-value**	**T^1 Median (IQR)**	***X*² *statistic (df)*** [a]	***p*-value**
Functional limitation	TiA	1.00 (.88)			1.00 (.75)		
	SS	1.50 (1.25)	1.289	.525	.50 (1.13)	5.58 .7	.061
	Control	1.25 (1.13)			1.50 (1.38)		
Physical pain	TiA	1.25 (.63)			1.00 (1.13)		
	SS	1.50 (.50)	4.681	.096	1.00 (1.38)	7.956	.019*[1]
	Control	1.75 (.88)			1.75 (1.75)		
Psychological discomfort	TiA	2.50 (1.63)			1.50 (.88)		
	SS	2.25 (.63)	1.771	.680	1.00 (.75)	7.171	.028*[2]
	Control	2.50 (1.63)			.00 (1.13)		
Physical disability	TiA	1.25 (2.00)			1.25 (.75)		
	SS	1.25 (1.25)	1.256	.534	.50 (1.31)	8.196	.017*[3]
	Control	1.75 (1.50)			1.75 (0.88)		
Psychological disability	TiA	0.50 (1.25)			1.00 (1.63)		
	SS	1.25 (2.00)	.543	.762	.25 (1.13)	.941	.625
	Control	0.50 (1.25)			.50 (1.25)		
Social disability	TiA	0.00 (.50)			.25 (1.00)		
	SS	0.00 (.63)	2.671	.263	.00 (.13)	2.994	.224
	Control	0.75 (1.63)			.25 (1.63)		
Handicap	TiA	1.25 (1.75)			1.00 (1.75)		
	SS	1.50 (1.63)	1.109	.574	.00 (1.00)	5.249	.072
	Control	1.25 (1.63)			.25 (1.63)		
Total score	TiA	1.11 (0.95)			1.04 (.66)		
	SS	1.50 (0.89)	.667	.716	.52 (.96)	5.329	.070
	Control	1.57 (0.98)			1.14 (.71)		

Note, a=Kruskal-Wallis test

Significant level set at *p*-value $P<0.05$*

[1]Significant between titanium alloy and control group, *p*-value 0.015

[2]Significant between stainless steel and control group, *p*-value 0.012

[3]Significant between titanium alloy and stainless steel group, *p*-value 0.017

There were significant differences found at intervention T_1 for physical pain (p=0.019), psychological discomfort (p=0.028) and physical disability (p=0.017) at T_1 between groups. *Post hoc* test revealed that there were significant differences between TiA and control group (p=0.015) for physical pain domain, between SS and control group (p=0.012) for psychological discomfort and between TiA and Ss group (p=0.017) for physical disability. However, there was no significant difference demonstrated for other domains (functional limitations, psychological disability, social disability, handicap and total score) between groups at T_1.

4. Discussion

Micro-implants in orthodontics as a part of treatment are widely accepted by orthodontists(Shirck, Firestone, Beck, Vig, Huja, 2011) and orthodontics patients. However, there is still lacking of evidence reporting on patient discomfort and OHQoL of patients following micro-implants insertion. This is because there is still a chance of risks and complications to patient who has received micro-implants in their orthodontics treatment (Kuroda & Tanaka, 2014; Kravitz, Kusnoto,2007).The present study was aimed to educate patients about the level of patient comfort by using OHIP-14 questionnaires.

In our study, mean age was 23.6 years and the range of age was 18 to 30 years. This assume patient were adult and able to understand OHIP-14 questionnaires. Female subjects were higher in both groups which were the limitation of this study which can be improved for the further study. The selection of control group subjects in the present study was patients who do not need micro-implants in their orthodontic treatment and the questionnaires given before active orthodontics movement to reduce bias. This was supported by previous study showed that there is no significant different degree of pain during archwire changes(Kawaguchi, Miyazawa, Tabuchi, Fuyamada&Goto, 2014).
As orthodontics patients are vulnerable to pain and discomfort by multi factorial causes in orthodontics treatment. Study had shown that six months after banding and bonding OHQoL of patients is deteriorated and with the ongoing orthodontics treatment the OHQoL is reduced(Liu, McGrath, Hagg, 2011).

The probability of patients having pain and discomfort toward the treatment need to be acknowledged by patients and the micro-implant insertion is not excluded. A study done showed patients experience pain after micro-implants insertion and took analgesics to relieve the pain. They also reported that men had higher pain perception as compared to women(Zawawi, 2014). However in the present study none of the micro-implants subjects reported taking analgesic. Pain also experience by patients who had mucosal flap opening for miniplates placement as temporary anchorage device (Kawaguchi *et al*, 2014). Micro-implants as temporary anchorage device showed outstanding method of choice when it is not need compliance from patients, lesser pain experience following insertion and deliver good bony anchorage. Vast studies reported that patients experience less pain and discomfort with self-tapping methods (Kuroda *et al*, 2007; Sandler *et al*, 2014; Baxmann*et al*, 2010; Kawaguchi *et al*, 2014).

However there is study which reported patient experience discomfort when micro-implants located at the palatal mucosa(Kawaguchi *et al*, 2014). This finding is in agreement with our study, the OHQoL of micro-implants groups showed significant different between TiA and control group and

this suggest that insertion of TiAmicro-implant will cause some discomfort and alter patients' OHQoL for physical pain domain. Physical disability domain was altered between the two groups of micro-implants. This maybe contributed by the type of TiA micro-implant used in this study which has a larger head than the Ss micro-implant used. Psychological discomfort in OHQoL was found altered between Ss and control groups.

Assessment pain and discomfort after insertion of micro-implants is assessed from after one hour(Kuroda *et al,* 2007), six hours(Zawawi, 2014), twelve hours, twenty-four hours (Kawaguchi *et al*, 2014), three day and up to fourteen days. However in present study the assessments were taken four weeks after micro-implant insertion during regime four weeks orthodontics visit. For upcoming study we suggest to use OHIP-14 after 24 hours insertion and longer time frames to assess OHQoL of patients. OHIP-14 questionnaire was selected as a tool to assess OHQoL patients with micro-implants as compared in the other previous studies because the researchers wanted to produce a knowledge orthodontic field and yet give an additional information to patient how micro-implant can affect their quality of life.

This preliminary study was carried out by analysis of validated questionnaires comparing orthodontic patients who received micro-implant as part as their orthodontic therapy and patients who underwent orthodontic therapy without micro-implant placement. Micro-implants were placed by a single operator. However, in the current study, comparison was made only to ten patients of each group respectively with convenient sampling. The study need more sample to express significant level of OHQoL so further study is welcomed.

5. Conclusions

This preliminary study showed that orthodontic treatment with micro-implants had significant different of OHQoL in physical pain (TiAvs control) and psychological discomfort (Ssvs control). There was a significant difference between Ss and TiA onphysical disability after 4 weeks' of micro-implant insertions (T_1).

6. Acknowledgment

This study has obtained ethical approval from UiTM Research Ethics Committee (File No: 600-RMI (5/1/6) which operates in accordance with ICH Good Clinic Practice Guidelines, Malaysia Good Clinical Practice Guidelines and Declaration of Helsinki. This study was financially supported by Research Management Institute grant UniversitiTeknologi MARA (File No: 600-IRMI/DANA5/3/LESTARI (0064/2016).

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