

Original Article

# Oral Health-related Quality of Life (OHRQoL) of Patients undergoing Micro-osteoperforations (MOPs) to Accelerate Orthodontic Space Closure

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## Abstract

**Objectives:** To assess and compare the oral health-related quality of life (OHRQoL) of orthodontic patients who had and had not undergone micro-osteoperforations (MOPs) during orthodontic space closure.

**Methods:** 27 orthodontic patients with fixed appliance who are undergoing orthodontic space closure with Niti coil springs were given the validated short version of the Oral Health Impact Profile (Malaysia) Questionnaire (S-OHIP) which was available in both Bahasa Melayu and English, containing 14 items. 17 patients underwent MOPs (MOP group) while 10 patients did not (control). Additive scores (ADD) were calculated by summing the response codes for the 14 items and simple count scores (SC) were calculated by a count of the number of items reported as occurring 'quite often' and 'very often'.

**Results:** A total of 24 patients responded to the questionnaire, with a response rate of 88.9%, and they comprised of 79.2% females and 20.8% males. There is no significant difference in the mean ADD ( $p = 0.347$ ) and mean SC ( $p = 0.446$ ) across both groups.

**Conclusions:** The reported oral health-related quality of life is similar for orthodontic patients who did and did not undergo MOPs.

**Keywords:** accelerated orthodontics, micro-osteoperforation, oral health-related quality of life, S-OHIP.

**Abbreviations:** ADD (Additive score); MOPs (Micro-osteoperforations); NiTi (Nickel titanium); LED (light emitting diode); OHRQoL (Oral Health-Related Quality of Life); SC (Simple count score); S-OHIP (Short version of the Oral Health Impact Profile (Malaysia) questionnaire).

## Introduction

Micro-osteoperforations (MOPs) is a comparatively less invasive variation of corticotomy, in which small perforations are made on the cortical bone to increase the rate of bone remodelling and

orthodontic tooth movement. Acceleration of orthodontic tooth movement by MOPs, via stimulation of the expression of inflammatory cytokines, have been observed in animal<sup>1</sup> and human studies<sup>2</sup>. Although it was reported that patients who had MOPs had only mild and bearable pain<sup>2</sup>, any effects on oral health-related quality of life (OHRQoL) remain unknown. Using the validated shortened version of Oral Health Impact Profile (Malaysia) Questionnaire (S-OHIP)<sup>3</sup>, an assessment

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of OHRQoL of patients receiving MOPs can be made and compared with patients who did not receive MOPs.

The OHIP was originally developed in Australia by Slade and Spencer<sup>4</sup>, and contains 49 items grouped into seven domains; namely functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap. It has been adapted into a short form to explore the problem of oral health in the Malaysian population<sup>3</sup>, containing 14 items within the same domains. S-OHIP had been previously used to assess the OHRQoL of other invasive procedures to accelerate orthodontic tooth movement namely corticotomy and piezosurgery<sup>5,6</sup>.

The objective of this pilot study is to assess and compare the oral health-related quality of life (OHRQoL) of orthodontic patients who did and did not receive micro-osteoperforations (MOPs) during orthodontic space closure.

## Materials and Methods

### Ethics Approval

Ethics approval application had been obtained at the faculty and university level prior to the commencement of study [Reference: 600-RMI (5/1/6)].

### The Study Design and Subject Selection

A total number of 27 participants were recruited from patients receiving orthodontic treatment at the Postgraduate Orthodontic Clinic, Faculty of Dentistry UiTM. An interview was done for all eligible participants, subject to a strict inclusion and exclusion criteria, as depicted in Table 1. They were supplied with written information sheets outlining the purpose of the trial. The patients were given time to decide, while having the upper and lower 0.019" x 0.025" stainless steel working archwire inserted after the levelling and alignment stage. Once the patient has

Inclusion criteria	Exclusion criteria
Patients currently undergoing fixed appliance therapy, requiring extraction of first or second premolars and space closure	Patients with systemic diseases
Patients with age range of between 18-45 years old	Patients with cleft lip and palate
Upper and lower pre-adjusted straight wire appliance (0.022" x 0.028" slot MBT prescription)	Patients with radiographic evidence of bone loss
Upper and lower 0.019" x 0.025" stainless steel working archwire in place for at least 4 weeks	Past or current periodontal disease
Informed written consent from the patient and, where appropriate, the guardian/parent	Patients who smoke
Class I canine relationship and ready to commence space closure	Patients who consume alcohol
	Patients who are currently pregnant
	Patients who are on long-term use of antibiotics, anti-inflammatory drugs, calcium-channel blockers, systemic corticosteroids, phenytoin and cyclosporin

Table 1: Inclusion and exclusion criteria

agreed to participate in the trial, informed and written consent was obtained.

The patients were divided randomly into 3 subgroups. The first group comprised of 10 subjects treated using NiTi springs without micro-osteoperforations (Group A), the second group comprised of 9 subjects treated using NiTi springs with micro-osteoperforations performed once in two months (Group B), while the third group comprised of 8 subjects treated using NiTi springs with micro-osteoperforations performed every month (Group C).

To minimize the risk of bias with regards to subject selection, stratified randomization according to the type of intervention was set up using opaque sealed envelopes. A trial coordinator (NAH) randomized the envelopes in blocks of 6, and this was unknown to the operator (SBA). All the subjects were randomly assigned to the 3 subgroups. Block randomization of 6 patients per block included 2 allotments each for all 3 intervention groups and this was to ensure equal distribution of all participating subjects. A number was written on a card and put into the envelopes before being sealed. When a patient agrees to participate in the trial, a sealed envelope was broken and the subjects were assigned according to the number on the card.

### Commencement of Orthodontic Space Closure

At the start of the orthodontic space closure phase, patients in both control and MOP groups began space closure with NiTi coil spring 9mm/200g, on a passive 019 x 025 stainless steel working archwire, that is attached directly on the first permanent molar and via stainless steel ligatures to the crimpable hook. The patients in the MOP group simultaneously received

MOPs, while patients in the control group did not.

### Application of MOPs

The device used to apply the MOPs, designed by PROPEL Orthodontics (Ossining, NY) (Fig. 1) was indicated to be used as a disposable, operative hand-held instrument. It has an Adjustable Depth Dial and indicating arrow on the driver body. The Adjustable Depth Dial can be positioned to 0mm, 3mm, 5mm, and 7mm of tip depth. The LED Depth Stop indicator will illuminate when the tip reaches the set depth thus preventing the tip from penetrating the bone beyond the targeted depth. The Retractable Sleeve covers and protects the tip at all times.

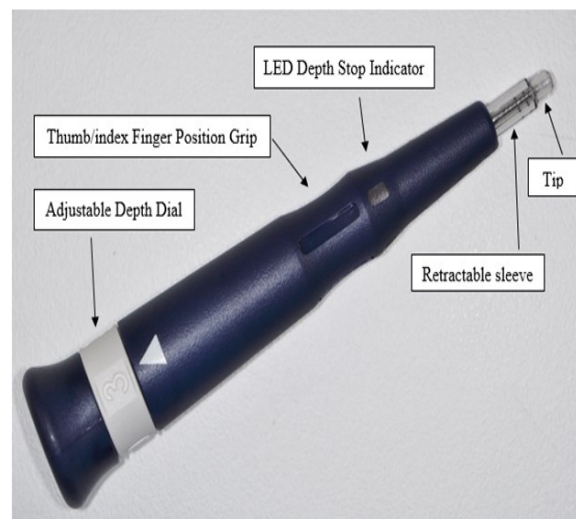


Figure 1: Propel Orthodontic Device

Prior to the MOP application, the patients were asked to rinse with Oradex, an antibacterial mouthwash that contains chlorhexidine digluconate 0.12% (Cavico, Malaysia) for about 1 minute prior to MOP application and 30 seconds post MOP application. This is to reduce the number of oral microbes thus reducing the chance of post-operative infection. A local anaesthetic agent, Citocartin (4% articaine with 1: 100,000 adrenaline) (Molteni Dental, Italy) was injected at the free gingiva adjacent to the MOP application

site by about a quarter of the cartridge. Once local anaesthesia had been achieved, two applications of MOPs were performed at the healed extraction site by using the disposable MOP device. A tactile evaluation was first carried out to evaluate the root location intraorally. Care was taken to note anatomical landmarks including mental foramen, mandibular canal, and sinuses. The MOP was applied by having the device at a 90-degree angle to the attached gingiva while keeping the tissue taut. The cutting edge was slowly engaged while the device handle was turned clockwise, with the turning of the device continued until the desired depth was reached for penetration of the cortical plate. This would be indicated by the red illumination of the LED Depth Stop indicator (Fig. 2). Each MOP was 1.5 mm wide and 3 mm deep. The procedure did not involve a flap, and no pain or antibiotic medication were prescribed (Fig. 3).

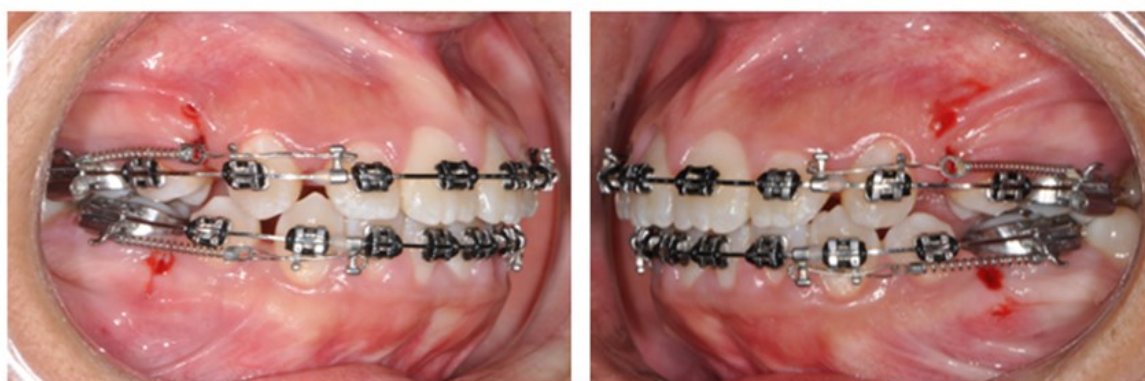
**The S-OHIP Questionnaire**

In order to assess the Oral Health Related Quality of Life (OHRQoL) of patients receiving MOPs, in comparison with control, all patients were given a set of questionnaire modified from the Oral Health Impact Profile (Malaysia) Questionnaire (S-OHIP) which was available in both Bahasa Melayu and



**Figure 2:** The LED Depth Stop indicator will illuminate to indicate that the desired depth had been reached

English, containing 14 items. The patients were divided into two groups, with patients in the control group undergoing space closure with NiTi coil spring without MOPs and patients in the MOP group undergoing space closure with the MOPs done at T0. Patients in the MOP group comprised of both the patients in Group B (MOP once in two months) and Group C (MOP every month). They were grouped together as the patients in both groups received MOPs at T0, and since the S-OHIP questionnaire was administered at T1 at which point the two groups (Group B and Group C) did not differ in terms of intervention. All the patients received the modified questionnaire during the T1 review visit,



**Figure 3:** Intraoral photos showing 2 MOPs at each extracted space

after 4 weeks of the commencement of space closure phase, and returned the questionnaire on the same day.

The original questionnaire was designed to find out the extent of problems related to the patient's teeth, mouth or denture and how it affects their daily lives. Section A of the questionnaire was concerned about oral health problems related to the teeth, mouth or dentures. The questions were modified by omitting the word 'denture' from the original questionnaire, with the questions and its meaning remaining unchanged to reflect the extent of discomfort caused by the application of MOPs to the patients. During the review visit after 4 weeks, the patients were given a set of the short version of the Oral Health Impact Profile (Malaysia) Questionnaire (S-OHIP) and returned the questionnaire on the same day. The S-OHIP was available in both Bahasa Melayu and English.

The 14 items in the questionnaire were grouped under 7 domains with 2 items under each domain (Table 2). The domains are functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap. The respondents were asked to answer on a five-point frequency Likert scale (very often, quite often, sometimes, once a while, never and don't know). The response codes for the frequency Likert scale ranged from 0 for 'don't know', 1 for 'never', 2 for 'once in a while', 3 for 'sometimes', 4 for 'quite often' to 5 for 'very often'.

### Scoring

Additive scores (ADD) and simple count scores (SC) were computed. ADD scores were calculated by summation of the response codes for the 14 items and SC scores were calculated by a count of the number of items reported as occurring 'very often' and 'often'. The ADD scores could range from 0 to 70 and the SC scores from 0 to 14. A high score indicated poorer OHRQoL.

### Data Analysis

Data was entered into a spreadsheet (Excel; Microsoft Corp., Redmond, WA, USA), and all statistical analyses were performed with SPSS Statistics for Windows (v20 SPSS Inc., Chicago, IL, USA).

Descriptive analysis was made and the significance of differences between groups were assessed using the Mann-Whitney U test.

### Results

All the respondents were Malay with an average age of 23.8 years and had tertiary level of education.

24 out of 27 patients returned the questionnaire, with 90% response rate from the control group and 88.2% response rate from the MOP group. The respondents were made up of 19 female and 5 male patients (Table 3). All questionnaires that were returned had complete data.

Both the mean ADD and SC scores of the MOP group were lower than the mean scores of the control group, but the differences were not statistically significant (Table 4).

Domains	Questions
Functional limitation	<p>Have you experienced difficulty chewing any food because of problems with your teeth and mouth? (Pernahkah anda mengalami kesukaran mengunyah sebarang makanan disebabkan masalah gigi atau mulut?)</p> <p>Have you felt problems related to your teeth or mouth cause bad breath? (Pernahkah anda merasakan yang masalah gigi atau mulut anda menyebabkan nafas anda berbau?)</p>
Physical pain	<p>Have you experienced discomfort eating any food because of problems with your teeth or mouth? (Pernahkah anda mengalami rasa tidak selesa untuk makan sebarang makanan disebabkan masalah gigi atau mulut?)</p> <p>Have you had ulcers in your mouth? (Pernahkah anda mengalami tompok-tompok putih yang pedih (Ulser) di dalam mulut?)</p>
Psychological discomfort	<p>Have you felt uncomfortable due to food getting stuck in between your teeth? (Pernahkah anda merasa tidak selesa disebabkan makanan terlekat di celah gigi anda?)</p> <p>Have you felt shy because of problems with your teeth or mouth? (Pernahkah anda merasa malu disebabkan masalah gigi atau mulut?)</p>
Physical disability	<p>Have you avoided eating certain foods because of problems with your teeth or mouth? (Pernahkah anda mengelak daripada memakan makanan tertentu disebabkan masalah gigi atau mulut?)</p> <p>Have you avoided smiling because of problems with your teeth or mouth? (Pernahkah anda mengelak daripada senyum disebabkan masalah gigi atau mulut?)</p>
Psychological disability	<p>Has your sleep been disturbed because of problems with your teeth or mouth? (Pernahkah tidur anda terganggu disebabkan masalah gigi atau mulut?)</p> <p>Has your concentration been disturbed by problems with your teeth or mouth? (Pernahkah tumpuan anda terganggu disebabkan masalah gigi atau mulut?)</p>
Social disability	<p>Have you avoided going out because of problems with your teeth or mouth? (Pernahkah anda mengelak daripada keluar berjalan-jalan disebabkan masalah gigi atau mulut?)</p> <p>Have you experienced problems in carrying out your daily activities because of problems with your teeth or mouth? (Pernahkah anda mengalami masalah untuk menjalankan kerja-kerja harian anda disebabkan masalah gigi atau mulut?)</p>

Domains	Questions
Handicap	<p>Have you had to spend a lot of money due to problems with your teeth or mouth? (Pernahkah anda terpaksa mengeluarkan perbelanjaan yang tinggi disebabkan masalah gigi atau mulut?)</p> <p>Have you felt less confident of yourself due to problems with your teeth or mouth? (Pernahkah anda merasa kurang yakin dengan diri anda disebabkan masalah gigi atau mulut?)</p>

Table 2: Items in the S-OHIP (M)

		Group		
		Control n=10 (%)	MOP n=17 (%)	Total (%)
Response rate		9 (90)	15 (88.2)	24 (88.9)
Gender	Male	3 (33.3)	2 (13.3)	5 (20.8)
	Female	6 (66.7)	13 (86.7)	19 (79.2)

Table 3: Response rates and respondents' demographic characteristics

		Group			
		Control	MOP	Total	*p-value
S-OHIP (M) scores	ADD score, mean (SD)	29.56 (9.63)	25.6 (8.03)	27.08 (8.68)	0.347
	SC score, mean (SD)	2.22 (2.68)	1.13 (1.36)	1.54 (1.98)	0.446
*by Mann-Whitney U test, p<0.05 is significant					

Table 4: ADD and SC scores across both groups

## Discussion

The S-OHIP(M) is reliable and appropriate for use in clinical trials and in clinical practice as an evaluative measure, with the items homogenous in measuring OHRQoL<sup>3</sup>. This short version of OHIP takes less time to complete, more feasible in clinical settings and has less impact on cost of administration and data management as compared to the long version. Besides being easier to certain

segments of the population, such as the frail and the elderly, having a shorter questionnaire would also decrease the chance of item nonresponse, which can lead to a loss of a substantial proportion of cases or problems arising from the necessity to impute missing data<sup>8</sup>.

To coincide with the patients' orthodontic review visit, administration of the S-OHIP questionnaire after a period of 4 weeks following MOP application was deemed suitable, as it gives time for the patients to

experience any impact of the MOPs to their quality of life, as well as letting the MOP wound on the attached gingiva heal.

A higher ADD and SC score indicates a poorer OHRQoL<sup>4</sup>. Although there were higher ADD and SC scores for the patients in the control group as compared to those who received MOPs, the differences were not statistically significant. This concurs with the study by Alikhani et al. (2013) that the MOP procedure does not cause more pain, discomfort and distress to the patients as compared to the patients who did not receive MOPs<sup>2</sup>.

The mean ADD scores of the patients who received MOPs in this study differ to those who received corticotomy in the studies done by Cassetta et. al (2012 & 2016), and this could be due to the fact that the patients received corticotomies during levelling and alignment phase<sup>5,6</sup> as compared to the space closure phase as in this study.

All patients that were eligible and participated in the questionnaire were of Malay ethnicity with females making up the majority, and while this may not represent the general composition of the population of Malaysia thus limiting the generalizability of this research finding, it reflects the general demography of patients that attended the Orthodontic Clinic in Faculty of Dentistry, UiTM. A different outcome may be seen with a more evenly composed ethnicity of the participants, with Saub and Locker (2006) observing that Indian patients having more impact on all domains than Malay and Chinese patients<sup>7</sup>.

There have been claims that micro-osteoperforations accelerates orthodontic tooth movement, either during levelling and aligning or during space closure, to ultimately shorten the duration of orthodontic treatment. These claims can and should, be substantiated with high-quality randomized-controlled trials.

## Conclusion

The reported quality of life of orthodontic patients who had MOPs were similar to those who did not have MOPs.

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