Original Article

Patients' Perceptions Regarding Microimplant as Anchorage in Orthodontics

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ABSTRACT

Objective: To determine patients' expectations, acceptance, and experience of pain with microimplant surgery compared to other orthodontic procedures.

Materials and Methods: Seventy-eight microimplants were placed in 37 patients as an anchorage unit for orthodontic treatment. Patients were asked to rate anticipated pain and pain experienced with various orthodontic procedures (tooth extraction, insertion of separators, initial tooth alignment, and microimplant surgery) on a visual analog scale (VAS) over a 7-day period. One month after insertion of microimplants, patients were asked to rate their acceptance of the procedure using a structured questionnaire.

Results: Unlike other orthodontic procedures, patients expected to experience a significantly higher level of pain with microimplant surgery than they experienced ($P < .001$). The postoperative pain experienced decreased continuously from day 1 to day 7 for all orthodontic procedures ($P < .05$). The total area under the curve (AUC) of pain experienced over the 7-day period was significantly larger for initial tooth alignment than for microimplant surgery ($P < .05$). Most patients were satisfied with the microimplant surgery (76%) and would recommend it to a friend or family member (78%).

Conclusions: Patients tended to overestimate the pain anticipated with microimplant surgery. Patients were accepting of the surgery and would recommend it to others.

KEY WORDS: Microimplant; Orthodontic treatment; Patient assessment

INTRODUCTION

Pain and discomfort are frequently encountered during orthodontic treatment.[1] Many studies have reported on the prevalence, magnitude, and time course of pain associated with various conventional orthodontic procedures including separation,[2,3] initial archwire alignment[4,5] and debonding.[6] The recent paradigm shift towards microimplants as an alternative anchorage device has grown increasingly in orthodontic care.[7] However, little is known about the pain associated with microimplants and how it compares to pain experienced from other orthodontic procedures.

Greater understanding of the pain experienced as a result of different orthodontic procedures is of paramount importance. Fear of pain associated with different procedures can contribute to patients' avoidance of orthodontic treatment.[8] Our knowledge in treatment perception can also help to provide patients with realistic expectations of the likely pain that will be encountered during orthodontic treatment, and thus can help educate for ''informed consent.''[9] Furthermore, it can provide an insight into the acceptance of this novel orthodontic anchorage device and support or refute its use.

In view of the dearth of information on patients' perspectives of pain related to the placement of microimplants, this study aimed to determine patients' experiences of pain associated with the placement of microimplants and to compare their experiences of pain with other orthodontic treatment procedures. In addi-

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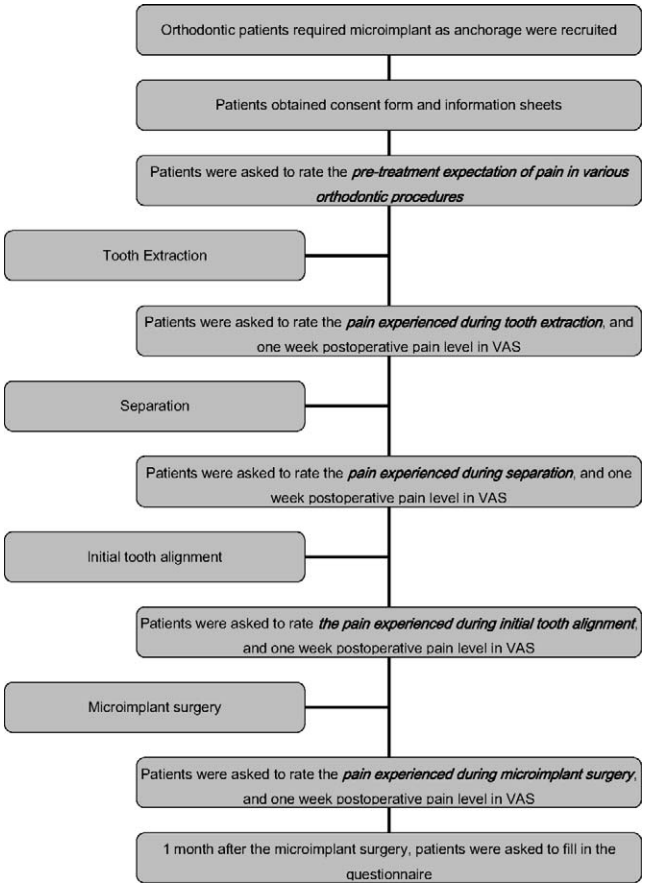

Figure 1. Study design flow diagram.

tion, it sought to assess patients' acceptance of microimplants as a new anchorage device.

MATERIALS AND METHODS

Sample

This was a prospective cohort study involving a consecutive sample of 37 patients (24 female and 13 male, mean age 23.5 years, SD ±10.9 years) requiring mircoimplants as anchorage for their fixed orthodontic appliance treatment at the Faculty of Dentistry, The University of Hong Kong. All surgical and orthodontic procedures followed a standardized protocol. Simple tooth extractions were performed under local anesthesia (2% lidocaine hydrochloride, 3M ESPE, Monrovia, Calif). Dental elastics separators (Dentaurum, Ispringen, Germany) with inner diameter of 2.1 mm were placed in the interdental areas mesial and distal to all first molars. Nickel-titanium archwires (GAC International Inc, Bohemia, NY) of 0.016 inch were used for initial tooth alignment. Microimplants (Dentos, Absoanchor System, Seoul, Korea) with a diameter of 1.3–1.4 mm and a length of 7 mm were placed in subjects under 0.5 mL of local anesthesia (2% lidocaine hydrochloride, 3M ESPE) with a one-step self-drilling procedure.[10]

Data Collection

All patients were informed of the necessary treatment stages for their orthodontic care in a standardized way at their orthodontic treatment planning consultation visit and received written information sheets of their treatment. Prior to each phase of treatment—(i) extraction, (ii) separation, (iii) initial alignment, and (iv) microimplants—patients were asked to rate their expected pain experience (P_{ex}) on a 100-mm visual analog scale (VAS) where ''0'' represented ''no pain'' and ''100'' represented ''the worst pain imaginable.'' Prior to leaving the orthodontic department on the day of their treatments (extraction/separation/initial alignment/microimplants), patients were asked to rate the pain they experienced during the procedure (P_{tx}) on another VAS. Subjects were then provided with a diary of VAS to rate the pain they experienced each day for 7 days (P_1, P_2, P_3, P_4, P_5, P_6, P_7) following the treatment they had received. In addition, 1 month following the placement of the mircoimplants, subjects completed an 11-item structured questionnaire with respect to symptoms experienced, functional disturbances follow-

Table 1. A Comparison of Patients' Expectation of Pain and Pain Experienced Intraoperatively With Different Orthodontic Procedures[a]

	Pretreatment Expectation of Pain of the Procedures (P_{ex})		Pain Experienced During Procedures (P_{tx})		
	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	*P* value
Separation	17.52 (14.08)	17.00 (27.00)	24.93 (23.56)	19.00 (38.50)	.231
Extraction	48.17 (23.08)	46.50 (26.25)	23.31 (22.63)	17.00 (26.50)	.000**
Initial alignment	37.89 (24.25)	36.50 (37.75)	37.19 (19.08)	33.00 (39.80)	.962
Microimplant	54.13 (24.24)	52.00 (27.00)	25.56 (23.38)	17.50 (33.50)	.000**
	Extraction : Microimplant (NS)[b]		(NS)		

[a] SD indicates standard deviation; IQR, interquartile range.

[b] $P > .05$ obtained from Friedman 2-way ANOVA and post test by Wilcoxon signed rank test comparing expectation of pain in extraction and microimplant surgery. NS indicates not significant.

** $P < .001$ obtained from Wilcoxon signed rank test comparing expectations of pain and pain experienced during tooth extraction and microimplant surgery.

Table 2. Comparison of Pain Experienced 1 Week After Different Orthodontic Procedures[a]

	Day 1		Day 2		Day 3	
	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)
Separation	23.93 (22.37)	19.50 (37.75)	23.21 (20.96)	21.50 (37.25)	19.19 (18.16)	18.50 (31.75)
Extraction	30.75 (22.94)	26.00 (29.62)	25.53 (23.98)	19.50 (39.75)	21.17 (23.01)	15.50 (32.00)
Initial alignment	44.43 (24.19)	45.00 (39.00)	42.51 (24.16)	45.00 (33.00)	37.86 (21.98)	41.00 (29.00)
Microimplant	36.61 (25.48)	34.00 (35.75)	30.78 (25.86)	27.50 (33.00)	25.00 (21.96)	23.50 (30.50)

[a] SD indicates standard deviation; IQR, interquartile range.
* $P < .05$ obtained from Friedman 2-way ANOVA comparing the AUC of initial alignment to microimplant surgery, tooth extraction and

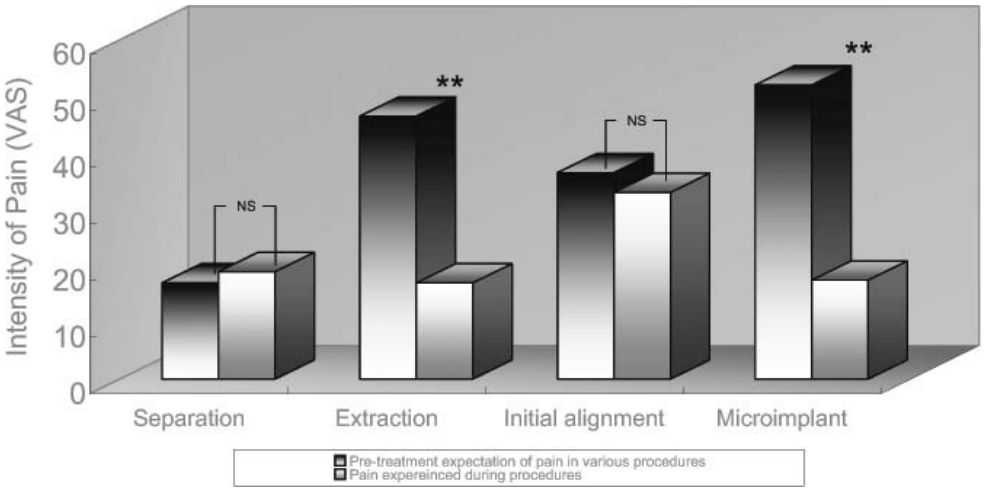

Figure 2. Comparison of patients' expectations of pain and pain experienced intraoperatively.

ing microimplant insertion, and their satisfaction of the microimplant treatment (Figure 1).

Data Analysis

Patients' expectations of pain (P_{ex}) and pain experienced (P_{tx}) in various orthodontic procedures were compared using Wilcoxon signed rank tests. Among the four orthodontic procedures, the differences in pain expected or pain experienced were explored using Friedman 2-way analysis of variance (ANOVA). Total pain experienced over the postoperative 7 days for the various orthodontic procedures was assessed using Wilcoxon signed rank tests. Furthermore, the pain experienced over the 7 days was plotted in a graph, and the area under the curve (AUC)[11] was calculated to determine their overall pain experience: $AUC = (1/2)\ \Sigma_{i=0}^{n-1}\ (t_{i+1} - t_i)(y_i + y_{i+1})$ where n = number of measurements, t = day of measurement, and y = mean pain score. Variations in overall pain experienced were assessed by determining variations in AUC scores using Friedman 2-way ANOVA for the various orthodontic procedures. Frequency tables were produced in response to questionnaire items of symptoms experienced, functional disturbances, and satisfaction of the microimplant treatment.

RESULTS

Among the 37 subjects, 78% (29) completed all assessments and were included in the analyses. The mean age ($\pm$SD) of participants was 23.5 $\pm$10.9 years (range 12–46 years); 65% were female. There was no significant difference in the age and gender profile of those who completed all assessments compared to the profile of the initial sample recruited ($P > .05$).

Patients' expectations of pain differed with respect to various treatment procedures ($P < .001$) (Table 1). Patients expected microimplants to cause more pain than the insertion of separators ($P < .05$) and initial tooth alignment ($P < .05$); however, there was no significant difference in the expected level of pain between microimplant and tooth extraction procedures ($P > .05$). Patients' experiences of pain during all treatment procedures were not significantly different ($P > .05$). Patients expected to experience more pain than they did with both tooth extraction ($P < .001$) and microimplants ($P < .001$) (Figure 2).

Patients' experiences of pain decreased significantly over the 7 days following all orthodontic procedures ($P < .05$) (Table 2). Overall pain experienced as calculated by AUC scores was significantly greater in initial

separation procedures in 1 week.

Table 2. Extended

Day 4		Day 5		Day 6		Day 7		Area Under Curve
Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	(AUC)
12.96 (13.42)	9.50 (27.75)	8.61 (9.710)	5.00 (17.50)	7.46 (8.21)	4.00 (13.75)	5.36 (6.25)	3.50 (8.00)	80.72
17.47 (22.36)	9.50 (24.25)	14.73 (20.70)	6.00 (18.75)	12.88 (20.90)	2.75 (13.50)	9.13 (18.84)	1.00 (8.50)	111.72
30.00 (21.07)	30.00 (34.00)	25.31 (34.00)	24.00 (34.00)	20.71 (19.99)	19.00 (30.00)	15.69 (15.87)	14.00 (21.00)	186.45*
20.22 (20.37)	13.50 (27.75)	16.36 (17.70)	11.50 (21.50)	13.72 (16.64)	8.50 (18.00)	11.33 (16.17)	6.50 (4.25)	130.05

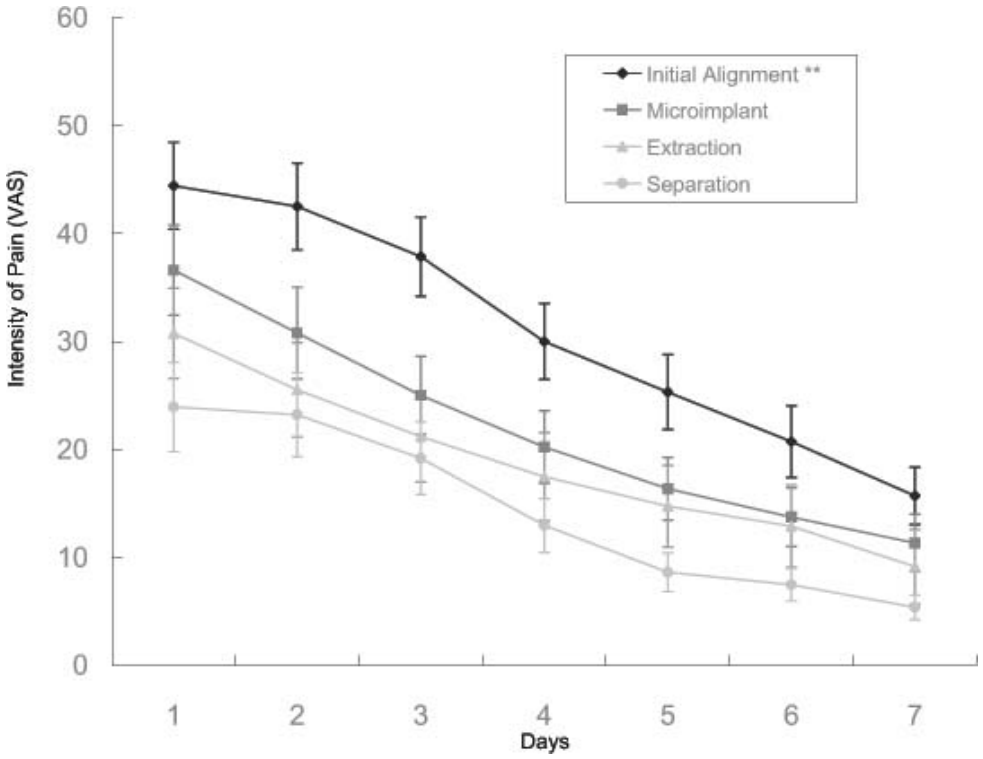

Figure 3. Diary of postoperative pain 1 week after different procedures.

tooth alignment compared to all other orthodontic procedures ($P < .05$) (Figure 3).

On recall 1 month after the placement of microimplants, over half of the subjects reported that they only experienced ''a little pain'' or ''no pain,'' and had ''no swelling'' around the surgical site (Table 3a). Regarding functional disturbance, the majority of patients (86%) reported food stacking around the microimplants, but fewer complained of speech disturbances (37%) (Table 3b). Most patients (78%) reported that they were satisfied with the microimplant surgery and would recommend it to others (Table 3c).

DISCUSSION

Pain is a complex sensation that varies from one individual to another, thus objective quantification of pain is difficult. Verbal scaling systems have been used in measurement of pain intensity, but verbal reporting may be distorted, both purposefully and unwittingly. Situational influences in the form of interviewer bias and experimenter demand are common.[12] The VAS is one of the most commonly used tools to assess pain intensity and has been shown to be a valid and reliable method of measuring discrete pain as well as being a sensitive, simple, reproducible, and universally accepted method of assessing pain.[13] Moreover, VAS can assess the relative change in the magnitude of pain over time on a linear scale.[14] Thus, the VAS was employed in the assessment of pain in this study.

The response rate of the study was high at 78%. The study group was predominantly female, as is common in an orthodontic study population.[15,16] However, there was no significant difference by gender with respect to pain intensity, and this concurs with other studies[5,17–20]; thus the analysis was conducted on the whole sample rather than separated by gender.

Table 3a. Perception of Pain With Microimplant Surgery

	Perception of Microimplant Surgery					
	Not at All	A Little	Moderately	Quite a Bit	Extremely	Total
Pain during operation	8 (22.2%)	18 (50.0%)	8 (22.2%)	1 (2.8%)	1 (2.8%)	36 (100%)
Swelling around the surgical site	20 (55.6%)	6 (16.7%)	8 (22.2%)	2 (5.6%)	0 (0.0%)	36 (100%)
Oral discomfort	6 (16.7%)	10 (27.8%)	10 (27.8%)	8 (22.2%)	2 (5.6%)	36 (100%)

Table 3b. Functional Disturbances After Microimplant Insertion

	Level of Functional Disturbance After Microimplant Insertion					
	Not at All	A Little	Moderately	Quite a Bit	Extremely	Total
Food stacking around the microimplant	5 (13.9%)	8 (22.2%)	12 (33.3%)	5 (13.9%)	6 (16.7%)	36 (100%)
Chewing ability disturbance	15 (41.7%)	7 (19.4%)	13 (36.1%)	1 (2.8%)	0 (0.0%)	36 (100%)
Interference during tooth brushing	6 (16.7%)	14 (38.9%)	11 (30.6%)	2 (5.6%)	3 (8.3%)	36 (100%)
Speech disturbance	23 (63.9%)	10 (27.8%)	3 (8.3%)	0 (0.0%)	0 (0.0%)	36 (100%)

Table 3c. Patient Satisfaction With Microimplant Treatment

	Very satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	Total
Satisfaction	4 (11.1%)	24 (66.7%)	6 (16.7%)	2 (5.6%)	0 (0.0%)	36 (100%)
			Yes	No	No Comment	Total
Consider treatment again			25 (69.4%)	2 (5.6%)	9 (25.0%)	36 (100%)
Recommend to friends and relatives			28 (77.8%)	1 (2.8%)	7 (19.4%)	36 (100%)
Worth it to spend money and time on treatment			29 (80.6%)	0 (0.0%)	7 (19.4%)	36 (100%)

Patients anticipated experiencing greater pain with microimplants and tooth extraction than they actually experienced. Perhaps the higher anticipated pain level relates to the fact that these are injection-related procedures compared to other orthodontic procedures.[21]

Patients' experiences of pain significantly decreased over the 7-day postoperative observation period, which is in accordance with other studies.[5,20,22] The majority of subjects reported ''little or no pain'' during the microimplant operation and 78% of patients overestimated the level of pain associated with microimplant surgery. This concurs with Scheffler's[24] findings where 91% of patients reported ''little or no pain'' during anchor placement and perceived their experience with skeletal anchorage to be better than they had anticipated. Patients' pain thresholds may have been different for microimplants compared to other treatment procedures as suggested by the adaptation-level theory of pain since microimplant surgery was performed after other orthodontic treatment procedures.[23] On recall of disturbance following treatment, discomfort and functional disturbance were minimal. Food stacking was common, but only rated as having a moderate level of disturbance. The majority of patients was satisfied with the microimplant treatment and would recommend it to others. This high level of satisfaction with mircoimplants is comparable to the satisfaction with conventional prosthetic implants.[25]

CONCLUSIONS

- Patients tended to overestimate the pain anticipated with microimplant surgery.
- The postoperative pain of microimplant surgery was significantly less than that of initial tooth alignment.
- Patients were accepting of the surgery and would recommend it to others.

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