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Immediate post-operative effects of different periodontal treatment modalities on oral health-related quality of life: a randomized clinical trial

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Abstract

Aim: Oral health-related quality of life (OHQoL) characterizes a person's perception of how oral health influences an individual's life quality. The aim of this study is to investigate how the treatment modalities may affect the immediate post-operative quality of life of patients with periodontitis.

Materials and Methods: Sixty psychologically and socio-demographically matched periodontitis patients were randomly divided into three groups [20 non-surgical (NS), 20 surgical (SG), 20 surgical plus enamel matrix protein derivative (S+EMD)]. The OHQoL was assessed with two patient-centred outcome measures [Oral Health Impact Profile-14 (OHIP-14) and General Oral Health Assessment Index (GOHAI)] in the post-operative period of 1 week.

Results: Whereas there were no differences of OHQoL at the baseline, the patients treated by surgery had reported that they had experienced a worse OHQoL compared with the NS and S+EMD groups both in the OHIP-14 and GOHA indexes ($p = 0.001$).

Conclusions: The results of this study clearly indicated that patient perceptions on the immediate post-operative period were significantly better in the NS and S+EMD groups when compared with the SG group. These findings need to be confirmed in further studies with larger populations.

Key words: enamel matrix protein derivative; non-surgical periodontal treatment; patient perception; quality of life; surgical periodontal treatment

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According to World Health Organization (WHO), *quality of life* (QOL) is defined as an individual's perception of their position in life in the context of the culture and value system in which they live and in relation to their goals, expectations and standards and concerns (Koller et al. 2005). Whereas the *''health related quality of life''* is usually defined in relationship with health and physical function, emotional well-being, general health perception and social function (Hegarty et al. 2002, Frisch & Hoboken 2006), *oral health-related QOL* (OHQoL) characterizes a person's perception of how oral health influences an individual's quality of life and overall well-being (Slade & Spencer 1994, Kressin et al. 2001, McGrath & Bedi 2001, Allen 2003, John et al. 2004). Evaluating an individual's OHQoL can show how satisfying the person considers life in these domains (Ring et al. 2005). QOL and OHQoL are broad-ranging concepts, which are strongly affected by personality characteristics, psychological state, socio-economic, socio-demographic and life-style factors and aspects of social and community environments (Allen 2003, Carr & Higginson 2003).

Although periodontal diseases are not life threatening, they can affect not only the ability to eat, speak and socialize but also the interpersonal relationships, daily activities and therefore, the ''goodness'' or ''quality of life'' (Cunha-Cruz et al. 2007). In clinical practice, OHQoL

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assessments may provide an understanding of the impact that periodontitis has on patients (Needleman et al. 2002, Ng & Leung 2006). Oral Health Impact Profile-14 (OHIP-14) (Slade 1997) is a kind of measurement that is designed to provide a comprehensive detection of the dysfunction, discomfort and disability attributed to oral conditions. In addition, the General Oral Health Assessment Index (GOHAI) (Atchison 1997) measures patient-reported oral functional problems and also assesses the psycho-social impacts associated with oral disease. Whereas OHIP-14 includes more information about functional limitations and pain, GOHAI gives greater weight to psychological and behavioural outcomes (Atchison 1997, Slade 1997, Locker et al. 2001).

Advanced periodontal treatment could be performed using either a non-surgical (NS) or surgical (SG) approach. Although the SG technique may lead to some complications such as persistent bleeding, sensitivity, swelling, infection and feelings of weakness in the first post-treatment week (Pack & Haber 1983, Curtis et al. 1985, Wang & Greenwell 2001, Hoexter 2006), it is generally agreed that open scaling and root planing give better access to the root surfaces especially in sites with greater probing depth (Claffey et al. 2004). On the other hand, the effects of NS therapy have also been proved in many clinical studies both in moderate (Badersten et al. 1981, Antczak-Bouckoms et al. 1993, Heitz-Mayfield et al. 2002) and deep pockets (Badersten et al. 1984, Lindhe et al. 1984, Hung & Douglass 2002, Suvan 2005).

Emdogain (Strauman AG, Basel, Switzerland) is a commercial product that consists of a gel containing hydrophobic enamel matrix proteins (EMD) extracted from porcine-developing embryonic enamel. EMD applied to the root surface in conjunction with SG periodontal therapy may promote periodontal regeneration as demonstrated in both animal experiments and clinical studies (Hammarström 1997, Heijl et al. 1997, Heden et al. 1999, Tonetti et al. 2002, Cortellini & Tonetti 2007). In addition, it has been proven that topically applied EMD in instrumented pockets enhances the early healing of periodontal soft-tissue wounds. Patients also report significantly less post-treatment discomfort at sites subjected to EMD application (Wennström & Lindhe 2002, Tonetti et al. 2004).

To date, the success of periodontal therapy has usually been demonstrated with clinical parameters such as bleeding on probing, probing pocket depth and clinical attachment level. However, there has been considerable debate on the use of these traditional outcome indicators because these parameters are just ''surrogate'' markers and they do not reflect the real patient-centred outcomes such as the consequences of periodontal disease and its treatment on the patients' daily OHQoL (Needleman et al. 2004, Lightfoot et al. 2005, Ng & Leung 2006). The patients and the periodontist might have different views on what the best treatment results are and for the most satisfactory results; patient-centred outcomes of periodontal therapy should be understood well (Kalkwarf et al. 1992, Fardal et al. 2002, Tonetti et al. 2004, Kloostra et al. 2006, Ng & Leung 2006). Although there are some researchers who have investigated the relationships between patient perceptions and periodontal disease and treatment, further studies are needed to produce more reliable outcomes (Lee et al. 2002, Needleman et al. 2004, Newton 2005, Vettore et al. 2005, Patel et al. 2006). It is well known that OHQoL is strongly affected by psychological and sociodemographic status; however, these key factors were overlooked in many of the previous studies. Therefore, the aim of this study was to compare the OHQoL of psychologically and sociodemographically matched chronic periodontitis patients who received three different treatment modalities (NS, SG and surgical+EMD application) during the first week post-treatment.

Materials and Methods

Study population

The participants of the study were chosen from 182 chronic periodontitis patients who referred to the periodontology department of Cukurova University between January and June 2006. The exclusion criteria of this study were identified as the presence of uncontrolled or poorly controlled diabetes, pregnancy or any other systemic diseases known to affect periodontal tissues. Patients who had received periodontal treatment in the last 6 months and smokers were also excluded. Local Ethics Committee of Cukurova University Faculty of Dentistry approval was obtained and written informed consent was obtained from all patients. Patients who had a minimum of 20 teeth with at least eight of them having >5 mm of attachment loss and at least one deep intrabony defect ($\geqslant 3$ mm) located in the interproximal area of mandibular molar region were subjected to the psychological measures.

Psychological measures

It is well known that anxiety, depression, stress and well-being strongly correlate with post-operative pain (Kloostra et al. 2006); these variables were assessed with standardized, reliable and valid instruments in order to create psychologically matched groups. Trait anxiety was measured with the state-trait anxiety inventory (STAI) (four-point answering scale ranging from 1 = ''low'' to 4 = ''high anxiety'') (Spielberger 1983). Depression was determined with the short version of the Center for Epidemiologic Studies depression scale (three-point answering scale ranging from 1 = ''hardly ever depressed'' to 3 = ''most of the time depressed'') (Radloff 1977). Stress was measured with the perceived stress scale (PSS) (a five-point answering scale ranging from 1 = ''never'' to 5 = ''always stressed'') (Cohen & Williamson 1988). Subjective well-being (SWB) was assessed (with the affect balance scale of a five-point answering scale ranging from 1 = ''low well-being'' to 5 = ''high well-being'') (Bradburn 1969). Only individuals who had scores 1 or 2 from STAI, PSS and SWB and a score of ''1'' for depression were included in this study. Depending on the statistical analysis of these parameters, 60 psychologically matched patients agreed to participate in the study (Table 1).

Randomization

After matching for sociodemographic parameters of age, gender, income, education and also for oral hygiene levels (full-mouth plaque scores $\leqslant 20\%$), these 60 subjects were assigned a patient number and randomly divided into three study groups according to a random-number table by one of the periodontists (M. C. H.).

Treatment modalities

The first group included 20 patients who received NS therapy (NS group), the second group included 20 patients who had conventional SG therapy (SG

Table 1. Mean anxiety, depression, stress and well-being scores of the surgically, NS and S+EMD-treated patients on the day of treatment and mean values for the clinical attachment levels at baseline

	NS treatment	SG treatment	S+EMD
No. of respondents	20	20	20
Anxiety (mean ± SD)	1.3 ± 0.5	1.3 ± 0.5	1.3 ± 0.5
Depression (mean ± SD)	1.0 ± 0.0	1.0 ± 0.0	1.0 ± 0.0
Perceived stress (mean ± SD)	1.3 ± 0.5	1.3 ± 0.5	1.2 ± 0.4
Well-being (mean ± SD)	1.2 ± 0.4	1.3 ± 0.5	1.4 ± 0.5
Clinical attachment level (mm) (at baseline)	4.38 ± 1.04	4.29 ± 1.02	4.40 ± 0.51

$p > 0.05$ for all treatment groups in all parameters.
NS, non-surgical treatment; SG, surgical treatment; S+EMD, surgical treatment with application of EMD.

group) and the third group (consisting of 20 patients) was treated by using SG methods combined with the use of EMD (S+EMD) (Table 1). All 60 subjects solely received oral hygiene instructions as the initial therapy (Lindhe et al. 1982, Lindhe & Nyman 1985) and the patients in the SG and S+EMD groups did not receive pre-SG scaling and root planing, because the aim of the study was to compare the immediate post-operative OHQoL after receiving one session of therapy only. At the baseline, there were no statistically significant differences in the mean attachment levels and full-mouth bleeding scores ($\leqslant 20\%$) in all three groups. All treatments were performed by the same periodontist (OO) in order to prevent inter-operator variations. The operator was also blinded to whether the patient undergoing surgery should receive surgery only, or inclusion of Emdogain towards the end of the procedure in order to assure avoidance of a biased SG technique. The total time frame for the treatments ranged between 45 and 60 min.

Treatments

The post-operative OHQoL parameters were assessed after the procedures for the left or right mandibular molar region for each group. In the NS group, the patients received scaling and root planing by Gracey curettes no. 7–8, 11–12, 13–14 and an ultrasonic scaler. The removal of retentive factors for dental plaque accumulation such as overhanging restorations was performed if needed. Local and systemic antimicrobial agents were not administered to any patient. For the group of surgery with and without application of EMD, a modified Widman flap was performed in each surgery patient and full mucoperiostal buccal and lingual access flaps extending from the mesial of the first premolar to the distal side of the second molar were raised. Granulation tissue and pocket epithelium were removed. Any remaining subgingival plaque and calculus were removed by scaling and root planning using curettes and an ultrasonic scaler. The SG area was rinsed with saline and a continuous suture with silk (3/0) was used for suturing. For the S+EMD patients, the wound area was irrigated with saline and the root surfaces were conditioned with EDTA gel for 2 min. EMD was applied under the mucoperiostal flaps and onto the exposed root surfaces using a syringe with a short blunt-ended needle. When applying the enamel proteins, efforts were made to avoid contamination of the SG area with saliva or blood (Hagenaars et al. 2004). All patients were strictly instructed not to use any medications such as analgesics or antibiotics, except for rinsing twice daily with 0.12% chlorhexidine.

Development of a Turkish version of the OHIP and GOHAI

One of the authors, a Turkish dentist fluent in both Turkish and English, translated the 49 items of the original version of OHIP and the 12 items of GOHAI into Turkish. Because the short version of OHIP (OHIP-14), which contains 14 items derived from the 49-item OHIP, appears to have good validity and reliability (Slade & Spencer 1994, Slade 1997), OHIP-14 was used in this study (Table 2).

OHQoL measurements

The impact of periodontal treatment on the patient's quality of life was assessed using two patient-centred outcome measures: Turkish versions of OHIP-14 and GOHAI. Patients were asked to rate the impact of their oral health on 14 key areas of oral health-related QOL. Responses to the items were recorded on a six-point scale: never = 0, seldom = 1, sometimes = 2, fairly often = 3, very often = 4 and all time = 5 (Atchison 1997, Slade 1997). The participants were informed about the details of the study and on how to complete the indexes. The evaluation period was 1 week for both indexes. The week included the day before treatment (baseline), and 7 days after treatment. On day 1, OHQoL was assessed 5 h after the treatments. Then, the patients were presented with a recovery diary and asked to complete the questionnaires daily for 7 days. Daily telephone interviews were performed with each patient in order to assure the daily completion of the questionnaires. All questionnaires were collected from the patients on the post-treatment first week control visit.

Data Analysis

Statistical analysis was performed using a computer program (SPSS version 12.0, SPSS, Chicago, IL, USA). For each continuous variable, normality was checked by the Shapiro–Wilks test. Because the data were not distributed normally, an appropriate non-parametric test was chosen. Continuous and ordinal data such as VAS scores were analysed using the Kruskal–Wallis test. Because analysis of variance was significant, comparisons were performed using the Mann–Whitney *U*-test. Time-dependent data were analysed by the Friedman test. Results were presented as mean ± SD and median. The total areas under the OHIP–time and GOHAI–time curves between the baseline and the seventh day were determined using the trapezoidal rule.

Results

The overall OHQoL scores demonstrated statistically significant differences within the three treatment groups. Whereas there were no differences in OHQoL at the baseline within the groups, the patients treated by surgery had reported that they had experienced a worse OHQoL (more functional limitations, more pain and discomfort, more psychological and behavioural impacts) compared with the NS and S+EMD groups both in the OHIP-14

(Table 3 and Fig. 1) and GOHAI (Table 4 and Fig. 2) starting from the first post-operative day ($p = 0.001$). There were no significant differences in OHQoL between the NS and S+EMD groups. Although the OHQoL scores were significantly decreasing for all treatment groups during the 1-week follow-up period, the NS and S+EMD groups had significantly lower scores than SG everyday after baseline. In the SG group, the worst OHQoL scores were recorded on the post-operative first and second days and returned to the baseline values after 1 week. In contrast, the improvement in OHQoL started immediately on the first day and continued to improve for the subsequent 7 days for the NS and S+EMD groups. These results were also confirmed by the area under the curve analysis (AUC), which is a summary measure that integrates serial assessments of a patient's perceptions over the duration of the study. The mean AUC values of SG were significantly higher than the S+EMD and NS groups both in the OHIP–time curve (241.6, 131.5 and 114.6, respectively) and in the GOHAI–time curve (180.2, 101.8 and 89.6, respectively).

Table 2. The questions of two questionnaires included GOHAI and OHIP-14 (Locker et al. 2001)

GOHAI	OHIP-14
Functional limitation	
Trouble biting/chewing food	Trouble pronouncing words
Uncomfortable to swallow	Sense of worse taste
Prevented from speaking	
Pain and discomfort	
Discomfort when eating	Painful aching in mouth
Use medication to relieve pain	Uncomfortable to eat foods
Teeth, gums sensitive to hot/cold	
Psychological impacts	
Unhappy with appearance	Been self-conscious
Worried or concerned	Felt tense
Nervous or self-concious	Difficult to relax
Uncomfortable eating in front of people	Been embarrassed
	Felt life less satisfying
Behavioural impacts	
Limit kinds or amounts of food	Diet been unsatisfactory
Limit contacts with other	Had to interrupt meals
	Been irritable with others
	Difficulty doing usual jobs
	Totally unable to function

OHIP, Oral Health Impact Profile-14; GOHAI, General Oral Health Assessment Index.

Discussion

Dentists and dental researchers have always been interested in the clinical outcomes of their treatments and have developed various parameters and indicators to measure them (Buck & Newton 2001). However, most of these objective measures only reflect the clinical end points of the disease processes and they give no indication of the impact of the disease process on the function or psychosocial well-being of the patient. Both periodontal status and treatment may also have a considerable impact on day-to-day life or life quality (Locker 1988, Needleman et al. 2004, Tonetti et al. 2004, Ng & Leung 2006, Cunha-Cruz et al. 2007). A greater understanding of the consequences of

Table 3. Median scores of functional limitation; pain and discomfort; psychological and behavioral impacts and total OHIP-14 scores at the baseline and post-treatment 7 days for all treatment groups

	Baseline	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Functional limitation								
Surgical	4.0	4.0	4.0	4.0	3.5	3.0	3.0	3.0
Surgical+EMD	3.0	3.0	2.0	2.0	1.0	1.0	1.0	1.0
Non-surgical	3.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
p^*	0.344	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Pain and discomfort								
Surgical	5.0	6.0	6.0	5.0	4.5	3.5	3.5	3.5
Surgical+EMD	5.0	4.0	3.0	3.0	2.0	2.0	2.0	2.0
Non-surgical	4.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0
p^*	0.432	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Psychological impacts								
Surgical	12.5	16.0	16.0	15.5	13.5	13.0	13.0	13.0
Surgical+EMD	11.0	10.0	8.0	7.0	6.0	5.0	5.0	5.0
Non-surgical	14.0	9.0	7.0	6.0	6.0	5.0	5.0	4.0
p^*	0.570	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Behavioral impacts								
Surgical	10.0	15.0	14.5	13.5	11.5	11.5	10.5	9.0
Surgical+EMD	10.0	9.0	7.0	6.0	6.0	5.0	5.0	4.0
Non-surgical	11.0	6.0	5.0	5.0	5.0	4.0	4.0	4.0
p^*	0.878	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total score of OHIP-14								
Surgical	30.0	42.5	41.0	37.5	33.5	31.5	30.0	27.5
Surgical+EMD	30.0	25.0	20.0	18.0	16.0	14.0	13.0	12.0
Non-surgical	29.0	20.0	17.0	15.0	14.0	12.0	12.0	11.0
p^*	0.952	0.001	0.001	0.001	0.001	0.001	0.001	0.001

OHIP, Oral Health Impact Profile-14; NS, non-surgical treatment; SG, surgical treatment; S+EMD, surgical treatment with application of EMD.

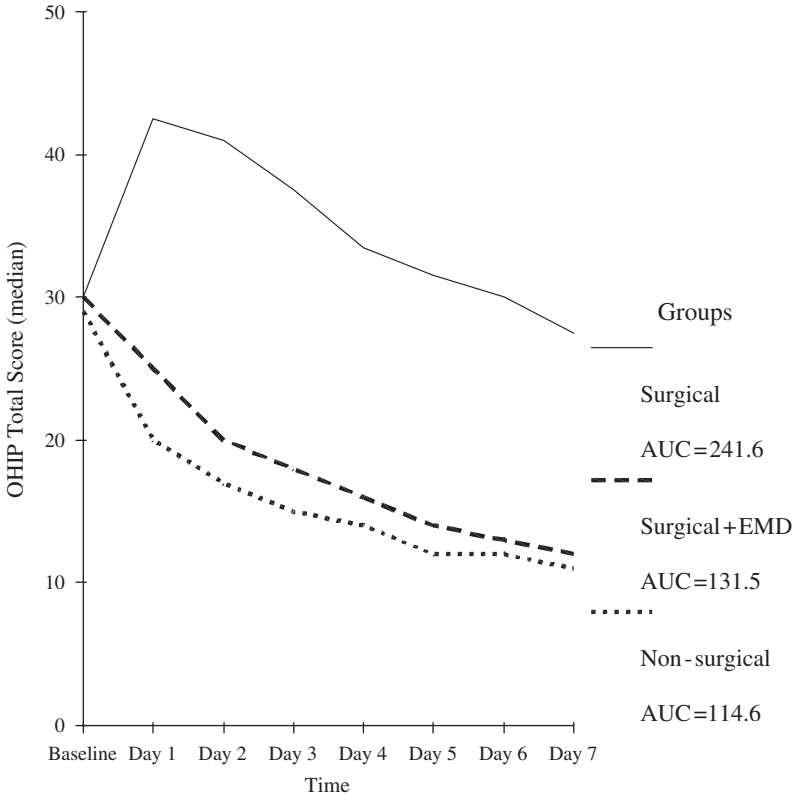

Fig. 1. Changes of total Oral Health Impact Profile-14 (OHIP-14) score between three groups and the mean area under the curve (AUC) values during the 1-week follow-up period ($p < 0.001$ for all three groups within time period).

periodontal disease and the effects of therapy is important in many aspects: in understanding and embracing patient perceptions of the impact of their oral health on their lives, in planning periodontal care that addresses patient needs and their key concerns, in evaluating outcomes of periodontal treatment from the patient's perspective and in drawing attention to the importance of periodontal care in society (McGrath & Bedi 1999, Tonetti et al. 2004, Ng & Leung 2006). Therefore, is currently, increasing attention is being given to the impact of periodontal treatments and conditions on subjective oral health and their broader physical, social and psychological effects (Tonetti et al. 2004, Kloostra et al. 2006, Ng & Leung 2006, Cortellini & Tonetti 2007). In addition, patient-focused issues have been recognized as a research priority area at the World Workshop on Emerging Science in Periodontology of 2003 (Tonetti et al. 2004).

There are only a limited number of studies, that have recently begun to explore the relationship between various satisfaction factors and periodontal treatment. In other words, researchers have begun to focus on patient-centred outcomes such as pain, anxiety, depression, stress and impaired well-being

Table 4. Median scores of functional limitation; pain and discomfort; psychological and behavioral impacts and total GOHAI scores at the baseline and post-treatment 7 days for all treatment groups

	Baseline	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Functional limitation								
Surgical	6.0	7.0	7.0	7.0	6.0	5.5	5.0	5.0
Surgical+EMD	7.0	5.0	4.0	4.0	3.0	3.0	3.0	3.0
Non-surgical	6.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0
p^*	0.475	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Pain and discomfort								
Surgical	6.5	10.0	10.0	10.0	9.0	9.0	8.0	7.0
Surgical+EMD	7.0	5.0	4.0	4.0	3.0	3.0	3.0	3.0
Non-surgical	7.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
p^*	0.300	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Psychological impacts								
Surgical	7.5	10.0	9.0	8.0	7.0	7.0	6.0	6.0
Surgical+EMD	7.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0
Non-surgical	8.0	5.0	4.0	3.0	3.0	3.0	3.0	3.0
p^*	0.805	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Behavioral impacts								
Surgical	4.0	4.0	4.0	4.0	3.0	2.5	2.5	2.0
Surgical+EMD	3.0	3.0	2.0	2.0	1.0	1.0	1.0	1.0
Non-surgical	3.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
p^*	0.437	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total score of GOHAI								
Surgical	24.5	31.0	30.5	29.0	25.5	23.0	23.0	21.5
Surgical+EMD	25.0	19.0	15.0	13.0	11.0	11.0	11.0	11.0
Non-surgical	26.0	17.0	12.0	11.0	10.0	10.0	10.0	10.0
p^*	0.799	0.001	0.001	0.001	0.001	0.001	0.001	0.001

NS, non-surgical treatment; SG, surgical treatment; S+EMD, surgical treatment with application of EMD; GOHAI, General Oral Health Assessment Index.

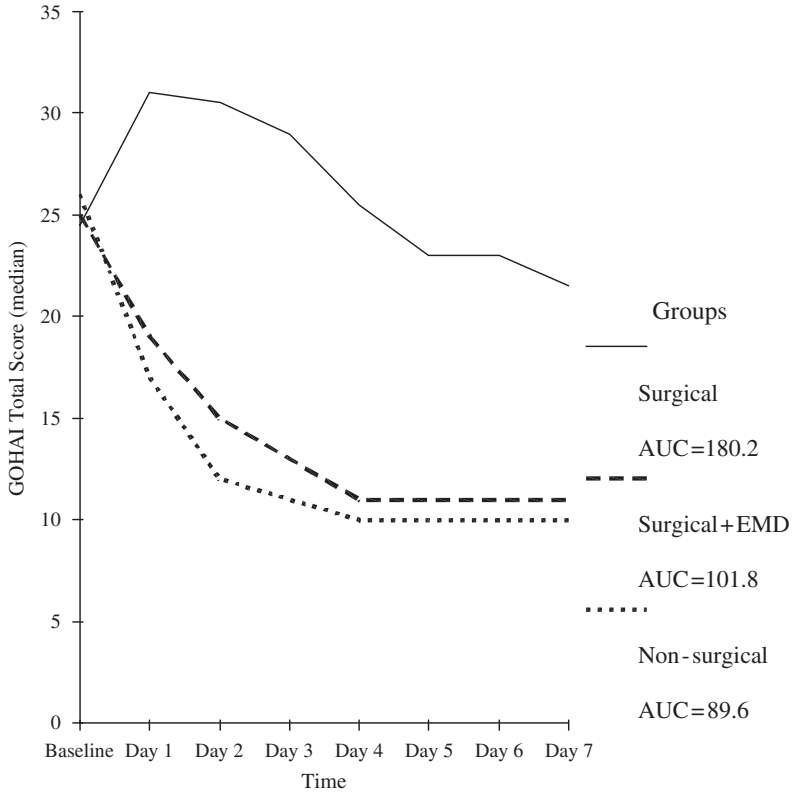

Fig. 2. Changes of total General Oral Health Assessment Index (GOHAI) score between three groups and the mean area under the curve (AUC) values during the 1-week follow-up period ($p < 0.001$ for all three groups within time period).

(Matthews & McCulloch 1993, Lee et al. 2002, Needleman et al. 2004, Tonetti et al. 2004, Lightfoot et al. 2005, Kloostra et al. 2006, Ng & Leung 2006, Cortellini & Tonetti 2007). Recent studies have demonstrated that clinical periodontal status is significantly associated with OHQoL. Needleman et al. (2004) investigated the OHQoL in a group of referred periodontal patients and found that the periodontal status has considerable effects on OHQoL. Furthermore, a study by Ng & Leung (2006) revealed that better periodontal conditions with a minimal history of periodontal destruction were more likely to be related to a better OHQoL. In other words, patients with high/severe periodontal attachment loss scored significantly higher negative values on the impact of oral health on their OHQoL. In addition to these investigations, Kloostra et al. (2006) explored how patients with SG *versus* NS periodontal treatment differ in trait anxiety, depression, perceived stress and well-being. Data from their study indicated that the SG patients reported more pain during the second week than the NS patients.

To the best of our knowledge, this is the first study to show that different periodontal treatment techniques can directly affect the OHQoL during the first post-treatment week in psychologically matched individuals probably due to the different physical, functional and psychological, behavioural effects that these techniques produce. There are only a few studies that have evaluated post-treatment symptoms of pain, and swelling and bleeding of the gingiva following surgery (Hagenaars et al. 2004, Tonetti et al. 2004, Cortellini & Tonetti 2007), in addition to considerations such as chewing comfort, aesthetics, speaking ability, the ability to maintain oral hygiene and an overall general satisfaction with the treatment provided. In one of these studies, all subjects filled out a questionnaire every day for the first 7 days following surgery to evaluate post-treatment complaints (Hagenaars et al. 2004). Another study evaluated the patient perceptions at 1 year (Tonetti et al. 2004). Both studies used the VAS analysis technique to investigate patient-centred outcomes. However, these studies were not performed on the psychologically matched groups, which may have an impact on the post-treatment OHQoL.

The results of the present study showed that the surgery plus Emdogain group (S+EMD) demonstrated similar OHQoL scores (including functional limitation, physical pain, psychological and behavioural impacts) as the NS group. The surgically treated patients scored significantly higher negative values on the impact of treatment on their OHQoL in both indexes. The periodontal surgery technique was perceived as having more negative impacts on OHQoL because it caused more physical pain (probably due to sensitive root surfaces and traumatized gingival tissues), which led to more physical disability and psychological impacts. In contrast, the NS-treated group exhibited the best outcomes in terms of immediate post-treatment OHQoL, while the score of the S+EMD group was closer. The data of this study clearly illustrated that the characteristics of the EMD improved the OHQoL compared with surgery alone.

EMD has been shown in numerous reports to improve clinical parameters and to mediate a regenerative healing response in addition to its antimicrobial effects (Hoang et al. 2000, Lyngstadaas et al. 2001, Needleman et al. 2002, Trombelli et al. 2002, Van Der Pauw et al. 2002, Murphy & Gunsolley 2003, Hagenaars et al. 2004, Sanz et al. 2004, Tonetti et al. 2004). Hoang et al. (2000) demonstrated that PDL cell wound-fill rates increased significantly compared with those of gingival fibroblasts when EMD is added to a medium containing both cell types. Similarly, a recent study conducted by Wennström & Lindhe (2002) showed that topically applied Emdogain in instrumented pockets enhances the early healing of periodontal soft-tissue wounds. It was also shown that the patients reported significantly less post-treatment discomfort at sites subjected to EMD application. In addition to these findings, Tonetti et al. (2004) have reported that 2 weeks following access flap surgery alone, tissue density (expressed as changes in CADIA units) decreased below the pre-SG level and tissue density remained below baseline values for the first 6 weeks of healing. Following application of EMD, on the other hand, already at week 2, tissue density appeared to be higher than before surgery. During the initial 6 weeks of healing, the soft-tissue CADIA values of

EMD-treated sites were significantly higher than those of the control treatment. These data support the clinical observation that EMD-treated sites display a more rapid healing with little clinically evident inflammation (Brett et al. 2002, Parkar & Tonetti 2004). All these observations indicate that EMD may influence soft-tissue healing, which may cause better post-operative patient perceptions in addition to its capability of promoting periodontal regeneration (Schonfeld & Slavkin 1977, Hammarström 1997, Heijl et al. 1997, Heden et al. 1999, Cortellini & Tonetti 2000, Needleman et al. 2002, Trombelli et al. 2002, Wennström & Lindhe 2002, Murphy & Gunsolley 2003, Sanz et al. 2004, Cortellini & Tonetti 2007). These studies seem to be in agreement with our findings that the application of EMD, in addition to surgery for treatment of periodontal defects, may improve the post-treatment OHQoL.

Besides the positive biological effects of EMD on rapid wound healing and post-operative OHQoL, possible psychological benefits of the product on patients should also be mentioned. Patients who were informed about the beneficial effects of this new technology product may feel that they are being treated in the best manner and receiving a high-quality treatment technique that may subsequently lead to better perceptions and trust for the provided therapy. In addition, this receipt of information from the provider to the patients may have improved the patients' familiarity, relation and trust in the provider, which in turn may have reduced the immediate post-operative OHQoL problems (Kloostra et al. 2006, Patel et al. 2006).

The observation period was limited to 1 week in this study and the main reason for this notion was the aim of evaluating immediate post-operative OHQoL after different treatment modalities. When patients better understand the improvement of their OHQoL even in the early stages of periodontal therapy, this may motivate them to keep their oral hygiene level higher and fully comply with the requirements for further therapy. These consequences may also lead to better compliance during the maintenance phase as the fear, pain and unwillingness to participate in their own care are among the main reasons for failing to comply (Wilson 1996).

The major limitation of this study was the small sample size. The study population was unique in which the patients were psychologically and sociodemographically matched; however, the sample size is a limitation to the generalizability of the present results. The effects of different treatment techniques on short- and long-term OHQoL in larger populations with various psychological status are currently not known and warrant further studies. Another possible limitation is that the role of psychological and perceptual factors was provided from self-reports, as patients may be inconsistent in expressing their personal views about their health (Aleksejuniene et al. 2002). It should also be mentioned that no analgesic or anti-inflammatory drugs were used in this study in order to evaluate the effects of treatments exclusively. With the use of these drugs, as it would be in the clinical setting, better OHQoL data could have been obtained.

In conclusion, the results of this study clearly indicated that patient perceptions of the immediate post-operative period were significantly better in the NS and S+EMD groups when compared with the SG group. Within the limitations of the study, these findings may provide an important step on the way to successful treatment. It has been reported that ''better understanding of the disease and novel treatment strategies are two of the lines which are being defined in a new era of periodontal treatment'' (Tonetti 2002). In accordance with this statement, ''better understanding of the patient perceptions'' can be added as another essential concept for choosing the treatment strategies and this is why the chosen therapy must be smoother so as to protect life standards.

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Clinical Relevance

Scientific rationale for the study: The actual subjective patient-centred outcomes of three different periodontal therapy modalities during the post-operative first week were compared in this study.

Principal findings: Despite the similar psychological and socio-demographic status in this small sample population, it was found that patients treated NS and treated surgically in combination with enamel matrix protein derivatives had better quality-of-life levels compared with the patients treated with surgery alone.

Practical implications: The results of this study suggest that the chosen modality of the periodontal treatment has a direct impact on the patients' immediate post-operative QOL.