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# Potential impact of surgical periodontal therapy on oral health-related quality of life in patients with periodontitis: a pilot study

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#### Abstract

**Aim:** To gain insight into the impact of periodontal surgery on oral health-related quality of life (QoL) of patients with periodontitis.

**Material and Methods:** Study participants were recruited from moderate to severe periodontitis patients. After initial periodontal therapy, participants received periodontal surgery. Oral Health-related Quality of Life Model for Dental Hygiene (OHRQL) was used to assess participant's QoL at each time point of periodontal evaluation (baseline, at least 3 weeks after initial therapy and 3–4 months after surgery).

**Results:** A total of 21 patients completed OHRQL assessment after surgery. Compared with baseline, a progressive improvement in periodontal parameters was observed during the periodontal therapy. The total mean OHRQL score at baseline ( $25.5 \pm 11.4$ ) was significantly reduced (improved) after initial therapy and after surgery ( $16.7 \pm 9.5$  and  $15.0 \pm 9.7$ , respectively; p < 0.01). However, no significant difference was found between the OHRQL score after initial therapy and that after surgery.

**Conclusions:** No significant differences in patients' oral health-related QoL were observed between post-initial therapy and post-surgery intervals, although a tendency of surgery to determine an improvement in QoL was observed when compared with post-initial treatment.

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# Conflict of Interest and Sources of Funding Statement

This study was supported in part by a grant from the Japanese Society of Periodontology, Tokyo, Japan. The authors declare that there are no conflicts of interest in this study. According to the World Health Organization (WHO 1948), evaluation of the health of subjects requires assessment of their physical, psychological, and emotional well-being, not merely confirmation of disease absence. General health and oral health have been addressed as significant for the quality of life (QoL) of a person (Gift & Atchison 1995). Thus, measurement of the impact of oral conditions on QoL is an important part of the assessment of an individual's health needs.

In dentistry, patient's perception regarding health-related QoL is

increasingly recognized as an important outcome of care (Slade 2002, Allen 2003, Locker 2004, Locker & Allen 2005). In periodontal treatment, objective measures such as improvement in gingival inflammation and gains in attachment provide important information on the disease status or treatment outcome. However, those traditional surrogate measurements give little insight into the impact on a patient. Patient-centred assessments are especially important in periodontitis in which their concerns may differ from the traditional clinical endpoints (Ng & Leung 2006, Jowett et al. 2009). Recently, there is increased interest in the impact of periodontitis on patient's daily lives including QoL (John 2005, Ng & Leung 2006, Cunha-Cruz et al. 2007, Bajwa et al. 2007, Jowett et al. 2009, Bernabé & Marcenes 2010, O'Dowd et al. 2010, Tsakos et al. 2010). This trend is consistent with the research priority designated for patient-centred measures during the 2003 World Workshop on Emerging Science in Periodontology (Tonetti et al. 2004). Also, it was suggested that subjective oral health-related QoL measurements should be considered true endpoints to assess periodontal treatment efficacy (Hujoel 2004).

To treat moderate to advanced periodontitis, surgical intervention is often indicated after initial therapy. In the treatment of deep pockets, open flap debridement results in greater probing pocket depth (PPD) reduction and clinical attachment gain (Heitz-Mayfield et al. 2002). However, periodontal surgery can impose certain postoperative discomfort such as pain, swelling, or tooth sensitivity. In other fields of dentistry, the importance of assessing changes in patient perceptions during surgical intervention has been shown (Cunningham et al. 2000, McGrath et al. 2003a,b, MaShugars et al. 2006, Lee et al. 2008). In case of orthognathic surgery, there is an assumption that patients accept short-term risks and discomforts in return for long-term benefits in terms of length or quality of their lives (Modig et al. 2006).

In early 1990's, Matthews & McCulloch (1993) postulated that patient perceptions of periodontal treatment may be used to address appropriateness of care issues, in

relation to surgical and non-surgical periodontal therapies. It is also important to note that patients differ in the degree to which they experience impaired well-being, when they face and experience periodontal treatment (Saletu et al. 2005). In a previous study, we showed that periodontitis had a negative impact on oral health-related OoL of the Japanese patients studied, and conventional non-surgical periodontal therapy ameliorated their OoL (Saito et al. 2010). It has been our concern that periodontal surgery may not be so effective, when the outcome is evaluated in terms of patient perceptions. However, to date, evidence regarding the effect of periodontal surgery on patient perception, specifically oral health-related QoL, appears to be limited.

The purpose of this study was to gain insight into the impact of periodontal surgery on perceived QoL in a population of patients with periodontitis in Japan, using a Japanese version of the Oral Health-related Quality of Life Model for Dental Hygiene (OHRQL) (Gadbury-Amyot et al. 1999, Sato et al. 2007).

# Material and Methods

A prospective clinical study was designed to investigate the impact of periodontal therapy on oral healthrelated QoL in patients with periodontitis. This study was conducted as part of a project research of the Japanese Society of Periodontology, Tokyo, Japan.

## Study population

Study participants were recruited from moderate to severe periodontitis (Page & Eke 2007) patients who visited the Suidobashi Hospital, Tokyo Dental College or Keio University Hospital, Tokyo, Japan between March 2009 and August 2010. Inclusion criteria consisted of having two or more inter-proximal sites with clinical attachment level  $(CAL) \ge 4 \text{ mm}$ , not on the same tooth, or two or more inter-proximal sites with PPD  $\geq$  5 mm, not on the same tooth, the presence of  $\geq 16$ teeth with a minimum of four molars, no extensive periodontal therapy in the previous 6 months, and good general health. Patients

were excluded if they were below 20 years of age, pregnant or lactating females, or had significant active caries or other oral diseases. The study protocol was independently approved by the institutional review boards, and written informed consent was obtained from all participants.

## Procedures

After collection of full medical and dental histories, a periodontal examination was carried out at baseline and 3-4 weeks after initial periodontal therapy. The following periodontal parameters were recorded at six sites for each tooth. The PPD and recession of the gingival margin (REC) were measured using Williams probe, and rounded to the nearest millimetre. Clinical attachment level (CAL) was derived from the algebraic sum of PPD and REC. The presence or absence of bleeding following measurement of PPD was recorded and full-mouth bleeding scores (FMBS) were calculated (Ainamo & Bay 1975). Several tooth-sites were excluded from the examination: impacted teeth. retained roots, grossly broken down teeth, and teeth which were too inaccessible to examine satisfactorily. The presence or absence of supragingival dental plaque was recorded by O'Leary plaque control record (PCR) (O'Leary et al. 1972). Then, patients responded to baseline questionnaire on oral health-related QoL (Phase I).

All patients received initial periodontal therapy consisting mainly of standard oral hygiene instructions, scaling, and root planing. The scaling and root planing was performed as quadrant-base using Gracey curettes and an ultrasonic scaler, usually under local anaesthesia. Very occasionally, a tooth with hopeless prognosis may be extracted. After a suitable interval for tissue healing (at least 3 weeks), re-evaluation was performed and patients were asked to respond to the second oral healthrelated QoL survey (Phase II).

Based on the results of re-evaluation, a further treatment plan was formulated and presented to patients. Those who needed and consented to periodontal surgery received quadrant-based open flap debridement. The criteria for surgery were based on the guideline by Japanese Society of Periodontology (2008): after initial periodontal therapy, they had at least one tooth with PPD deeper than 4 mm with radiographic evidence of bone loss.

The surgical procedures were performed by four periodontists. The surgical intervention was provided over single or multiple treatment episodes, according to the treatment needs. Following surgery, patients received an oral antibiotic (typically 300 mg/d of cefdinir) and a non-steroidal anti-inflammatory drug (typically lornoxicam 4 mg/d) for 3 days. They received re-evaluation and completed the final QoL survey, at ~12–14 weeks after the final surgery (Phase III).

#### Measures

For the assessment of oral healthrelated OoL, the OHROL (Williams et al. 1998, Gadbury-Amyot et al. 1999, Keselyak & Gadbury-Amyot 2001) was used. The Japanese version of the instrument was developed as described previously (Sato et al. 2007). The final and refined instrument has been clinically tested with periodontitis patients (Kikuchi et al. 2009. Saito et al. 2010). The instrument comprised of seven conceptual domains (pain; dry mouth; eating/ chewing function; speech function; social function; psychological function; health perceptions) with a total of 22 subscale items. Using the OHRQL instrument, participants were asked to rate the impact of their oral health on their OoL. The scoring was performed as described previously (Saito et al. 2010). Briefly, for the first 20 items, respondents were asked to answer each item using a five-point response scale from never (score 0) to always (score 4). For the last two items, respondents were asked to indicate how they perceive their oral and general health compared to others in the same age group. The summation score from each of the 22 items produced overall OHRQL scores ranging from 0 (representing best impact possible) to 84 (worst impact).

#### Data management and statistical analyses

Data were compiled by creating a computerized file using the information provided by both centres and proofed for data-entry errors. The following analyses were performed using a software package (InStat 3.10, GraphPad, La Jolla, CA, USA).

Correlations between variables were computed using Spearman rank correlation. Friedman test with Dunn's multiple comparisons test was used to determine the longitudinal changes between baseline and post-treatment periodontal parameters and OHRQL scores. A *p*-value < 0.05 was considered to be statistically significant.

Change scores for the OHRQL were calculated by subtracting the scores after treatment from the corresponding pre-treatment scores. To further interpret patient-centred outcomes, we calculated the effect size (ES) by dividing the change scores by the OHRQL baseline or post-initial therapy standard deviation. Cohen (1992) has defined an ES of 0.2 as small, 0.4 as moderate, and 0.8 as large. The larger the ES, the greater the magnitude of change as a result of the intervention.

#### Results

The formal power calculation was not performed for this study. This pilot would allow for basis upon which appropriate power calculation can be made for a larger study. A total of 45 patients with periodontitis were recruited. Three were ineligible. After initial periodontal therapy, four patients were lost to follow-up. Among the eligible patients who completed the first and second OHRQL questionnaires (Phase I and II), two patients did not complete the treatment, two were lost to followup, and 13 were placed under maintenance care. The reasons for drop-outs were mainly patients' no-shows and cancellations with unknown reasons. Twenty-one patients (mean age: 56 years; 5 men and 16 women) completed the final OHRQL following periodontal surgery (Phase III), and they were subjected to data analysis of this study. Demographic characteristics and clinical parameters of the participants at baseline are shown in Table 1. The demographic characteristics and clinical parameters of the drop-outs did not significantly differ from the surgical patients who were eligible for the third follow-up analyses.

Table 1. Demographic characteristics and clinical parameters of participants at baseline (total n = 21)

Variables	Measurements	
Gender		
Men	5	
Women	16	
Mean age (years; mean [SD])	56.4 (9.7)	
Age range (years)	31-71	
No. of teeth (mean [SD])	25.5 (2.2)	
Probing pocket depth (PPD) (mm; mean [SD])	3.52 (0.70)	
Clinical attachment level (CAL)	3.99 (0.86)	
Full-mouth bleeding scores (FMBS; %)	28.4	
Sites with PPD $\geq 4 \text{ mm} (\%)$	36.3	
Mean plaque control record (PCR; %)	44.9	

#### Baseline OHRQL

At baseline, all participants perceived that their oral health status impacted on their life qualities in one or more ways. At baseline, the variation in patient score was very wide; the median was 27 and the interquartile range (IQ) was 19.5 -31. At baseline, OHRQL scores for pain, eating and chewing function, and psychological function were relatively high (data not shown).

The patients had a poor initial outlook on their oral health, with 52% rating their overall oral health as poor when compared with others of the same age group. The self-perceived health of 5% of participants was poor, indicating that general health was not a major concern.

There was no significant correlation between baseline (Phase I) OHRQL scores and participant's age or clinical variables (Table 2).

# Eect of periodontal therapy on clinical parameters

Initial periodontal therapy resulted in a statistically significant improvement in all periodontal parameters measured (p < 0.05) except FMBS (Fig. 1). A statistically significant improvement in PCR was also noted (44.9% at phase I versus 27.8% at phase II; p = 0.0028).

Table 2. Correlation between baseline oral health-related quality of life model for dental hygiene (OHRQL) scores and demographic or clinical variables (n = 21)

Baseline variables	r	р
Age	-0.140	0.546
No. of teeth	-0.370	0.223
Probing pocket depth (PPD)	-0.382	0.087
Clinical attachment level (CAL)	-0.315	0.165
Full-mouth bleeding scores (FMBS; %)	-0.029	0.902
PPD > 4 mm (%)	-0.326	0.149
Plaque control record (PCR)	-0.015	0.947

r, Spearman rank correlation coefficient.

Periodontal surgery (open flap debridement) resulted in an even greater level of clinical resolution from the Phase I parameters (p < 0.001) (Fig. 1). At Phase III (after surgery), a progressive improvement from Phase II (after initial therapy) was achieved in all parameters (p < 0.05~0.01).

Minimal tooth loss was noted after periodontal therapy (mean number of lost teeth was 0.4 at Phase II and 1.0 at Phase III).

#### Eect of periodontal therapy on OHRQL

Initial periodontal therapy resulted in a significant improvement in the mean total OHRQL score of the participants (p < 0.01) (Fig. 2).

As illustrated in Fig. 2, periodontal surgery resulted in a significant improvement from the Phase I OHRQL score (p < 0.01). At Phase III, however, no further significant improvement from the Phase II score was achieved.

When the correlation between the Phase III OHRQL score and change in periodontal parameters was sought by Spearman rank correlation, the improvement in percentage sites with PPD  $\geq 4$  mm showed a significant negative correlation (r = -0.4746, p = 0.0297) (i.e, the greater the improvement in percentage sites with PPD  $\geq 4$  mm, smaller the OHRQL score at Phase III). (Table 3).

#### Change score and effect size

To further elucidate the impact of each treatment step on patients' life



*Fig. 1.* Change in clinical parameters; (a) probing pocket depth (PPD); (b) clinical attachment level (CAL); (c) Full-mouth bleeding scores (FMBS) (%); (d) sites with PPD  $\geq 4 \text{ mm}$  (%). Data were expressed as mean  $\pm$  standard deviations. Phase I, at baseline; Phase II, after initial therapy; Phase III, after surgery \*p < 0.05; \*\*p < 0.01; \*\*\*p < 0.001; ns, not significant, Friedman test with Dunn's multiple comparisons test.

qualities, change score and ES were calculated (Table 4). The mean change score from Phase I was greater at Phase III, compared to that at Phase II. The change score was minimal from Phase II to Phase III. As assessed by the individual change in total OHRQL score, 76% (16 of 21) of participants exhibited improvement in their OHRQL change scores at Phase II (data not shown). Among those with improved



*Fig. 2.* Change in the total OHRQL socres. Data were expressed as mean  $\pm$  standard deviations. Lower score denotes better QoL. Phase I, at baseline; Phase II, after initial therapy; Phase III, after surgery \*\*p < 0.01, Friedman test with Dunn's multiple comparisons test; ns, not significant.

Phase II

*Table 3.* Correlation between Phase III OHRQL scores and change in periodontal variables (n = 21)

Phase I

Total OHROI

0

Change in periodontal variables	r	р
Probing pocket depth (PPD)	-0.222	0.335
Clinical attachment level (CAL)	0.005	0.984
Full-mouth bleeding scores (FMBS: %)	-0.224	0.328
$PPD \ge 4 \text{ mm (\%)}$	-0.475	0.030

r, Spearman rank correlation coefficient.

*Table 4.* OHRQL change score and effect size (ES) (n = 21)

Phase	Phase I to II	Phase I to III	Phase II to III
Change	8.9 (8.6)	10.6 (11.6)	1.7 (7.9)
ES <sup>b</sup>	0.8	0.9	0.2

Data were expressed as mean (standard deviations).

<sup>a</sup>Higher score denotes more improvement.

 ${}^{b}ES = 0.2$ , small; 0.4, moderate; 0.8, large.

OHRQL scores at Phase II, 50% (n = 8) showed a lower (improved) score and 44% (n = 7) showed a higher (worse) score at Phase III.

In contrast, OHRQL score for 23% (5 of 21) of participants showed either no change or increase at Phase II. 40% (n = 2) of them showed a lower (improved) score and 60% (n = 3) continued to show a higher (worse) score at Phase III.

Large ESs were seen for the change from Phase I to Phase II or Phase III. In contrast, low ESs were noted for the change from Phase II to Phase III.

Phase III

#### Discussion

Although recent decades have witnessed a surge in the area of oral health-related QoL research, relatively little is known about the influence of periodontal treatment on patient's QoL. This study is part of our ongoing effort to delineate the impacts of periodontitis and its treatment on patients' life qualities. The primary goal of this study was to gain basic information about the oral health-related QoL of patients undergoing periodontal surgery. We found a statistically significant improvement from baseline in clinical parameters and oral health-related QoL of periodontal patients already treated in a conventional (non-surgical) way, after receiving surgical periodontal therapy (open-flap debridement). However, initial periodontal therapy appeared to play a greater role in overall improvement of QoL. This extends our previous finding of positive effect of initial periodontal therapy on QoL (Saito et al. 2010), by highlighting the impact of periodontal surgery. Our study is among the first to investigate the potential impact of surgical periodontal therapy on QoL in patients with periodontitis, in association with periodontal status variables.

Initial periodontal therapy implemented in the present study was considered to be effective in terms of improvement in most of the periodontal parameters measured (Fig. 1). The treatment was effective from patients' perspectives as well (Fig. 2). This trend in OoL improvement after non-surgical periodontal therapy was in agreement with the previous report by our group (Saito et al. 2010) and recent studies by others (Bajwa et al. 2007, Aslund et al. 2008, Jowett et al. 2009, O'Dowd et al. 2010). In the present study, periodontal surgery resulted in an even greater resolution of the periodontal parameters. A trend towards further improvement in OHRQL score was observed after surgery (Fig. 2), although it may not be appropriate to claim that any effects on patients' QoL assessed after surgical intervention are due to surgery alone. These patients were initially treated conventionally and this has resulted in improvement in their QoL.

One notable finding was that the lower post-operative OHRQL score was correlated with a clinical resolution of the periodontal pockets (percentage sites with PPD  $\geq 4$  mm) from baseline, although no significant correlation was initially noted between baseline parameters and OHRQL scores. This may have an implication for future research with regard to the association of disease severity and patients' perceived impacts during periodontal treatment.

Given the importance of patients' QoL in periodontal care, better knowledge regarding the type and quality of periodontal treatment that generate the greatest improvement in QoL is necessary (Ozcelik et al. 2007, Bernabé & Marcenes 2010). In the present study, question arises as to the contribution of the surgical intervention to overall improvement in oral health-related QoL. One of the ways to interpret patient-centred outcomes is by calculating ESs (Cohen 1992). Evaluation of the ES also provides insight into the pattern of the OHRQL scores during treatment. In the present study, the ES for change scores from baseline was 0.8 after initial therapy and 0.9 after surgery. These values indicate "large" improvement from baseline. The ES for change scores from postinitial therapy to post-surgery was small (0.2).

These general trends towards improvement were consistent with the results from the comparison of the mean total OHRQL scores. Collectively, these findings suggest a major role for initial periodontal therapy in ameliorating overall oral health-related QoL during the course of periodontal treatment. This finding is in contrast with the substantial contribution of periodontal surgery to the clinical resolution of participants' periodontal conditions. It is generally more difficult to reduce lower scores to the extent of higher scores (floor effect) in QoL studies. (Bajwa et al. 2007, Hyde et al. 2006). It might be argued that the OHRQL scores after initial therapy were already reduced to the extent that any further improvement would not be significantly reflected after surgery.

With regards to assessment of changes in QoL before and after periodontal treatment, Tsakos et al. (2010), investigated the minimally important difference (MID) (Guyatt et al. 2002, Revicki et al. 2006, 2008) in the Oral Impact on Daily Performances (OIDP). In their study, MID corresponded to a moderate ES. It will be necessary to further elucidate the clinical relevance or meaning of OHRQL change we observed.

It is noteworthy that the mean total OHRQL score increased (worsened QoL) after surgery in 7 of 16 patients, who had presented the reduced score (better OoL) after initial therapy. In these patients, "eating and chewing" and "psychological function" were the relatively compromised OHRQL domains after surgery (data not shown). We can never overlook the fact that OHRQL score for 23% (5 of 21) of participants showed either no change or even an increase at Phase II and 60% (3 of 5) continued to show a higher (worse) score at Phase III. In these patients, likewise, "eating and chewing" and "psychological function" were the relatively compromised OHRQL domains after surgery. Giving special attention to these domains may retain or ameliorate patient's QoL during the surgical phase of periodontal treatment. On the contrary, 40% (2 of 5) showed the reduced score (better QoL) after surgery, although initial therapy failed to ameliorate their QoL. For these patients, surgical periodontal therapy seemed to have an added impact on their QoL. These results further indicate that the impact that therapy will

have on patient's oral health-related QoL is unique, and QoL is indvidual in nature.

In third molar surgery, McGrath et al. (2003a) reported that, in attaining an improvement in oral health-related QoL, patients are likely to experience and endure a considerable reduction in life quality in the immediate postoperative period. In the present study, we were interested in assessing change in QoL after periodontal surgery over a long-term period. However, the impact of the patient perception of the immediate postoperative period on a long-term change in QoL needs to be investigated.

In the present study, surgical intervention was performed by four dentists with varied clinical experience. In a future large-scale study, it is necessary to assess whether any relationship between clinician's experience and patient perceptions exists, during periodontal therapy. Also, the relationship between the disease severity and OHRQL score change needs to be further investigated.

There are relevant limitations of this study that should be noted. First, this pilot study was non-random and uncontrolled in design and employed small sample size. The criteria we used for the patient selection may not be sufficient to identify moderate to severe periodontitis cases. The limited severity of periodontitis may be one reason for the absence of significant differences in OHRQL between post-initial therapy and post-surgery intervals. In this study, we used a single instrument to assess oral health-related QoL. At this time, we cannot provide evidence about the sensitivity to change of the measure used. As QoL is a multifactorial concept, it may be necessary to utilize multiple instruments (Skaret et al. 2004, Shugars et al. 2006, Guzeldemir et al. 2009). It may also be necessary to develop a condition-specific (Allen 2003) version of the OHRQL instrument. Lack of additional analysis of impacts of other implicit dental problems or sociodemographic factors is another limitation.

Despite these limitations, our study adds salient data to the limited literature examining the impact of periodontal treatment on oral healthrelated QoL. Our current effort is directed at evaluating QoL during maintenance care to establish the long-term and lasting benefits of periodontal treatment.

# Conclusions

Within limits, our findings suggest that during the course of periodontal treatment, initial periodontal therapy plays a major role in ameliorating patient's oral health-related QoL. No significant differences in oral healthrelated QoL were observed between post-initial therapy and post-surgery intervals, although a tendency of periodontal surgery to determine an improvement in oral health-related QoL was observed when compared with post-initial treatment.

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#### **Clinical Relevance**

Scientific rationale for study: Patient perception of periodontitis and treatment is becoming increasingly important. However, evidence regarding the effect of periodontal surgery on oral health-related QoL is scarce. son of surgical and non-surgical therapy. Journal of Periodontology 64, 990–997.

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health-related QoL provides an important information regarding how a patient perceive his or her periodontal condition and its treatment.

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