
Oral Health Related Quality of Life (OHRQoL) outcomes at the time of orthodontic appliance removal and three months into retention

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Background: Oral health-related quality of life (OHRQoL) has become an important measure of orthodontic treatment outcome. However, it is unclear how long OHRQoL benefits manifest themselves following the removal of the orthodontic appliances.

Objectives: To investigate differences in OHRQoL recorded at the time of orthodontic appliance removal and three months into retention.

Setting and sample: Described is a prospective outcome study of 59 consecutive participants treated in a hospital-based clinic between 2015 and 2018. The patients comprised three groups: those who received orthognathic surgery (N = 15), those who had an orofacial cleft (N = 30) and those who had no-surgery/no-cleft (N = 14). Each individual completed an age-specific OHRQoL questionnaire that categorised them as either an adolescent (N = 37) or an adult (N = 22) participant.

Method: The OHRQoL questionnaires were completed at the time of appliance removal (T0) and again three months into retention (T1). The Child Perceptions Questionnaires (CPQ₁₁₋₁₄-ISF8 and P-CPQ8) were used for adolescent participants and their parent/caregiver, respectively, while the short-form Oral Health Impact Questionnaire (OHIP-14) was used for the adults.

Results: The OHIP-14, CPQ₁₁₋₁₄-ISF8 and P-CPQ8 detected improvements in overall and domain scores between T0 and T1 for all patient groups. Moderate effect sizes (0.2–0.7) were observed in all the domain, overall and group mean scores.

Conclusions: Post-treatment orthodontic OHRQoL outcomes improve over the three-month period following appliance removal. The use of these measures should be delayed beyond the immediate time of appliance removal to allow the benefits of orthodontic treatment to be appreciated.

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Introduction

A malocclusion is a relatively common condition that can adversely affect a person's function and psychological well-being.¹ Most orthodontic patients seek treatment for aesthetic reasons that often have an underlying psychological component.² The orofacial region holds importance to individuals because of its role in social acceptance and perceptions of attractiveness, intelligence and overall physical health. The importance of these psychological factors in influencing treatment need and outcome has resulted in a greater focus on self-reporting assessment tools and patient-centred care.³

The use of oral health-related quality of life (OHRQoL) assessments has been advocated in orthodontics because a wide range of domains is covered including functional, psychological, and social aspects.⁴ Such measures have an important role in understanding patients' subjective evaluations and experiences of oral health.⁵ OHRQoL has been defined as the extent to which oral disorders impact on aspects of daily life that are important to the patient, and particularly, impacts of sufficient magnitude, whether in severity, frequency or duration, to affect an individual's perception of their overall life.⁶

Although OHRQoL self-report questionnaires are

commonly used in orthodontic outcome studies, few investigations were found that have explored outcomes in a short-term retention follow-up period. Healey et al. reported substantial improvements in OHRQoL between the time of appliance removal and 21 months post-treatment for adolescents treated in private orthodontic practices.⁷ That study, which used the Child Perception Questionnaire (CPQ), suggested that the full benefits of orthodontic treatment were not realised until sometime after the appliances were removed; however, it was not clear how soon after appliance removal this occurred.

Another unanswered question is whether improvements occur in different groups of orthodontic patients; for example, is the improvement of similar magnitude and timing in those with varying severities of malocclusion? Antoun et al. indicated suggestive OHRQoL improvements at the time of removal in three groups of participants treated in a hospital clinic setting. The subjects were adolescents with severe malocclusions, adolescents with an orofacial cleft (OFC) and adults requiring combined orthodontic and orthognathic surgery. The outcomes were measured using the Oral Health Impact Profile (OHIP) questionnaire.⁸ The greatest OHRQoL improvement occurred in the orthognathic patient group, whereas the least improvement occurred in adolescents with OFC. In a five-year follow-up of the same patients, Nichols et al. found that the OHRQoL improvements had been sustained for the combined orthodontic and orthognathic treatment and conventional orthodontic treatment groups but not for those with OFC.⁹

According to current knowledge, no studies have been undertaken to assess OHRQoL changes between appliance removal and a short period of post-removal follow-up. Therefore, the aim of the present study was to investigate OHRQoL at the time of orthodontic appliance removal and three months into retention review by assessing three different orthodontic patient groups.

Methods and materials

The present study received approval for Out-of-Scope research from the New Zealand Health and Disability Ethics Committee, and written informed consent was obtained from all participants.

Fifty-nine consecutive patients who had completed fixed appliance treatment between January 2015

and December 2018 at Christchurch Hospital (in Christchurch, New Zealand) were divided into three patient groups: adults with severe skeletal discrepancies who required combined orthodontic and orthognathic surgery ('Surgery' group, N = 15); patients with OFC who required orthodontic treatment as part of their multidisciplinary management ('Cleft' group, N = 30); and patients without OFC who met the hospital eligibility criterion for a handicapping malocclusion, as assessed using the Dental Aesthetic Index¹⁰ ('Standard' group, N = 14). Additional inclusion criteria were the availability of a completed Impact Short Form (ISF8) of the Child Perception Questionnaires (CPQ₁₁₋₁₄-ISF8 and PCPQ-8)^{8,11,12} or the OHIP-14¹³ at the time of appliance removal (T0) and at a subsequent follow-up retention check appointment approximately three months post-removal (T1). The type of questionnaire used was determined by the age at which the orthodontic treatment commenced, with those aged 14 years or younger completing the CPQ on both occasions, while the older patients completed the OHIP-14.

Data were collected retrospectively for the sample's sociodemographic characteristics, which included date of birth and gender, as well as residential address. Deprivation status was determined using an area-based measure, the NZDep13, in which nine variables collected from the national Census database were used to allocate a deprivation score to each mesh block. Each patient's residential address was geocoded to its corresponding mesh block and then assigned a neighbourhood deprivation score, in which areas with scores 1–3 were classified as 'low deprivation', 4–7 'medium deprivation' and 8–10 'high deprivation.'

The OHRQoL for adolescents was assessed using the 8-item Child Perception Questionnaire Impact Short Form (CPQ₁₁₋₁₄-ISF8)¹¹ and the short form Parental-Caregivers Perceptions Questionnaire (P-CPQ8), the first used with the patient, and the second used with the parent/caregiver. The short form P-CPQ8 was considered a reliable proxy evaluation of a child's OHRQoL.¹² For each questionnaire, respondents were asked to recall the frequency of specific events during the past three months using a five-point Likert-type scale ranging from 'never' (scoring 0), 'once or twice' (scoring 1), 'sometimes' (scoring 2), 'often' (scoring 3), or 'every day/almost every day' (scoring 4). In the analysis of the CPQ, the oral symptoms and functional limitations were combined into a single

domain of 'symptoms/functions' while emotional and social well-being were combined into a single domain of 'well-being'.¹⁴ Total CPQ₁₁₋₁₄-ISF8 and P-CPQ8 scores were computed by summing the item scores for each measure, with a higher score indicating poorer OHRQoL.

The questionnaire also included three global items for validation purposes, which asked the respondent to comment on the appearance of their teeth compared to others of similar age, the health of their teeth, lips, jaws or mouth and how the condition of their teeth, lips, jaws or mouth affected their life overall. Possible responses for the first question were 'Among the nicest' (scoring 0), 'Better than the average' (scoring 1), 'Average' (scoring 2), 'Below average' (scoring 3) and 'Among the worse' (scoring 4). Responses for the second question were 'Excellent' (scoring 0), 'Very good' (scoring 1), 'Good' (scoring 2), 'Fair' (scoring 3) and 'Poor' (scoring 4). Possible responses for the third global question were 'Not at all' (scoring 0), 'Very little' (scoring 1), 'Some' (scoring 2), 'A lot' (scoring 3) and 'very much' (scoring 4).

The OHRQoL for adults was assessed using the short-form Oral Health Impact Profile (OHIP-14) questionnaire that measures people's perception of the social impact of oral disorders on their well-being.¹³ The 14 OHIP-14 items may be divided into the seven domains of functional limitation, physical discomfort, psychological discomfort, physical disability, psychological disability, social disability and handicap.¹² The OHIP-14 uses a five-point Likert scale coded as 'very often' (scoring 4); 'fairly often' (scoring 3); 'occasionally' (scoring 2); 'hardly ever' (scoring 1) and 'never' (scoring 0). An individual's overall score can range from 0 to 56, whereas each domain scores ranged from 0 to 8. A higher OHIP-14 score indicated a greater impact on OHRQoL.

Statistical analysis

Statistical analysis was undertaken using the statistical package SAS (version 9.4 M6; SAS, Cary, NC). Observed differences in means or proportions at one time were tested for statistical significance using Wilcoxon Signed Rank test. The effect size was determined by dividing the mean change score by the standard deviation of the T0 score to give a dimensionless measure of effect. Effect size statistics of less than 0.2 indicated a small clinically meaningful

change, 0.2 to 0.7, a moderate change, and greater than 0.7, a large change.¹⁵

Results

Just over half of the sample consisted of patients treated for a cleft (N = 30), with the remaining cohort split between surgery (N = 15) and standard malocclusion cases (N = 14), reflecting the hospital clinic-based priorities for accepting patients for orthodontic treatment (Table I). A total of 37 patients completed the CPQ₁₁₋₁₄-ISF8 at both T0 and T1. Of the 34 patients who completed the P-CPQ8 at T0, 30 (88.2%) completed it at T1. The OHIP-14 was completed by 22 individuals at both T0 and T1.

There were consistent gradients at T0 in mean CPQ₁₁₋₁₄-ISF8 and P-CPQ8 scores across the response categories of the global items (Table II), indicating satisfactory construct validity. Those who reported 'below average' or 'among the worse' for dental appearance relative to others, as well as 'fair' to 'poor' oral health, and those who rated the condition of their teeth, lips, jaws or mouth affected their life overall 'a lot' or 'very much' had higher mean scores.

There were substantial improvements in the mean overall and domain scores for the CPQ₁₁₋₁₄-ISF8, P-CPQ8 and OHIP-14 between the time of appliance removal (T0) and T1 (three months post-removal follow-up; Table III). The improvements in the mean overall scores were observed in the three patient groups. Moreover, several domain scores suggested improvements, all with moderate effect sizes.

Discussion

Short-term outcomes of orthodontic treatment can be considered as equally important as long-term results. The aim of the present study was to investigate OHRQoL at the time of appliance removal and three months into retention follow-up using three different orthodontic patient groups, to determine how early into retention review positive improvements could be observed. The OHIP-14, CPQ₁₁₋₁₄-ISF8 and P-CPQ8 detected clinically important improvements in domain and total mean scores, indicating that the patients had reflected more positively on the outcome of their orthodontic treatment at T1.

The above was observed for all patient groups with moderate effect sizes observed between T0 and T1,

Table I. Baseline numbers at time of removal by sociodemographic characteristics of subjects (brackets contain percentages, unless otherwise specified).

	Completed questionnaire		
	CPQ ₁₁₋₁₄ -ISF8 / P-CPQ8	OHIP-14	All combined
Sex			
Male	19 (51.3)	11 (50.0)	30 (50.8)
Female	18 (48.7)	11 (50.0)	29 (49.2)
Mean age at removal	15.3 (2.3)	20.4 (4.0)	17.6 (4.2)
Mean time elapsed (days)	106.3 (30.9)	110.8 (49.7)	108.2 (39.6)
Deprivation level ^a			
Low	14 (37.8)	4 (18.2)	18 (30.5)
Medium	18 (48.6)	13 (59.1)	32 (54.3)
High	5 (13.5)	5 (22.7)	10 (17.0)
Ethnicity ^b			
NZ European	28 (75.7)	18 (81.8)	46 (78.0)
Māori	3 (8.1)	0 (0.0)	3 (5.1)
Other	6 (16.2)	4 (18.2)	10 (16.5)
Patient Type			
Standard	9 (24.3)	5 (22.7)	14 (23.7)
Cleft	28 (75.7)	2 (9.1)	30 (50.8)
Surgery	0 (0.0)	15 (68.2)	15 (25.4)
All combined	37 (62.7) / 34 (57.6)	22 (37.3)	59 (100.0)

^a NZ Dep 2013 ^b Self-reported ethnicity

Table II. Mean CPQ₁₁₋₁₄-ISF8 and P-CPQ8 scale scores by responses to global questions at T0 (brackets contain standard deviations, unless otherwise specified).

	Mean CPQ ₁₁₋₁₄ -ISF8	Range	Mean P-CPQ8	Range
Appearance				
Among the best/Better than average	7.4 (4.5)	0-19	4.9 (4.0)	0-15
Average	6.6 (4.8)	1-16	7.6 (4.5)	1-16
Below average/Among the worst	15.3 (4.1)	10-20	15.3 (5.0)	10-22
Oral health				
Excellent/Very good	6.2 (4.2)	0-19	6.2 (4.9)	0-18
Good	9.3 (5.5)	1-20	7.2 (6.2)	1-22
Fair/Poor	14.0 (2.8)	10-16	11.0 (4.1)	6-16
Impact on life				
Not at all/Very little	6.5 (3.6)	1-15	5.3 (4.9)	0-18
Some	8.6 (4.8)	1-16	9.5 (4.2)	6-15
A lot/Very much	10.0 (7.0)	0-20	9.4 (5.8)	2-22

suggesting that these were indeed important changes in response following treatment.

Reductions in the adolescent (CPQ₁₁₋₁₄-ISF8) response scores were closely matched by their parent/caregiver (PCPQ-8) in both the domain and total scores. However, the adolescents reported higher symptom scores, whereas their parent/caregivers reported higher

scores in the well-being domain. The mean adolescent total scores at T0 and T1 were higher than those reported by their parent/caregivers.

The reductions observed indicated that all participant groups had reflected more positively on their experiences of orthodontic treatment at the follow-up appointment compared to time of appliance removal.

Table III. Changes in mean OHRQoL scale and domain scores from appliance removal (T0) to three months post-removal follow-up (T1) (brackets contain standard deviations, unless otherwise specified).

	T0	T1	Change in score	Effect size
<i>CPQ₁₁₋₁₄-ISF8 (N=37)</i>				
Symptoms	4.5 (3.1)	3.0 (1.8)	1.5 (3.0)	0.5 (moderate) ^a
Wellbeing	3.2 (2.8)	1.7 (1.5)	1.5 (2.6)	0.5 (moderate) ^b
Mean overall score	7.8 (5.2)	4.7 (3.1)	3.1 (5.0)	0.6 (moderate) ^b
<i>P-CPQ8 (N=34)</i>				
Symptoms	3.8 (2.7)	2.2 (1.9)	1.6 (3.7)	0.6 (moderate) ^c
Wellbeing	3.4 (3.6)	1.8 (2.1)	1.6 (4.3)	0.4 (moderate)
Mean overall score	7.1 (5.6)	4.0 (3.6)	3.1 (7.2)	0.6 (moderate) ^d
<i>OHIP14 (N=22)</i>				
Functional limitation	0.7 (1.3)	0.1 (0.5)	0.5 (1.4)	0.4 (moderate)
Physical pain	1.2 (1.5)	0.3 (0.7)	0.9 (1.4)	0.6 (moderate) ^e
Psychological discomfort	1.3 (2.1)	0.3 (1.1)	1.0 (2.0)	0.5 (moderate) ^f
Physical disability	0.4 (1.2)	0.0 (0.0)	0.4 (1.2)	0.3 (moderate)
Psychological disability	0.6 (1.1)	0.3 (0.9)	0.3 (0.9)	0.3 (moderate)
Social disability	0.2 (0.7)	0.0 (0.0)	0.2 (0.7)	0.3 (moderate)
Handicap	0.2 (0.6)	0.1 (0.6)	0.1 (0.5)	0.2 (moderate)
Mean overall score	4.6 (6.5)	1.1 (3.4)	3.5 (6.4)	0.5 (moderate) ^g
<i>Patient group mean score</i>				
Standard CPQ ₁₁₋₁₄ -ISF8 (N=10)	8.1 (5.3)	4.4 (2.9)	3.7 (1.2)	0.7 (moderate)
Cleft CPQ ₁₁₋₁₄ -ISF8 (N=27)	7.6 (5.1)	4.8 (3.0)	2.9 (1.0)	0.6 (moderate) ^a
Surgery OHIP-14 (N=14)	4.9 (6.6)	0.6 (1.0)	4.3 (2.8)	0.6 (moderate) ^h

Wilcoxon Signed Ranks test

^a $p = 0.004$; ^b $p = 0.001$; ^c $p = 0.033$; ^d $p = 0.050$; ^e $p = 0.005$; ^f $p = 0.017$; ^g $p = 0.015$; ^h $p = 0.007$;

This may be a result of the participants having had time in which to adjust to their improved occlusions and occlusal settling and to reflect on the aesthetic, social, and emotional outcomes of their treatment as well as on the absence of their appliances.¹⁶ The three global ratings of appearance, oral health and overall well-being demonstrated that CPQ₁₁₋₁₄-ISF8 and P-CPQ8 had good construct validity, demonstrating that they were valid measures of OHRQoL in this study.

However, there are several factors that must be considered when interpreting the study findings. The generalisability of the findings may be limited as the study sample consisted of three different patient groups all of which had relatively severe orthodontic malocclusions and all were treated in a single hospital-based centre. The patient group sample sizes were relatively small and, although the study detected important differences in OHRQoL, future studies

would benefit from larger samples with sufficient power to analyse different subgroups. The inability to conduct multivariate modelling, and thereby control confounders and compare particular treatment approaches, is a weakness of this study. Although the time period between the use of the questionnaires was limited to approximately three months, the extent to which detected changes over time reflected orthodontic treatment itself or other aspects of their treatment such as surgery may also be a limitation. Furthermore, the study participants should be followed for longer to evaluate the stability of OHRQoL over time, including after the cessation of the retention appliances. The use of the CPQ₁₁₋₁₄-ISF8 outside its upper age limit (mean age at appliance removal 15.3 years) is another consideration, although its use was determined by the age (under 14 years old) at which orthodontic treatment commenced. It should also be considered that Healey et al.⁷ used the CPQ₁₁₋₁₄-ISF8

in a cohort study of adolescents who were followed until their late teens, and with no apparent issues with validity or responsiveness.

The inclusion of different patient groups and the ability to report on two age-specific OHRQoL measures are strengths of this study. The use of more than one global item enabled a number of concurrent validity checks, with positive results. Previous studies have indicated that patients with severe malocclusions and dentofacial deformities reported positive improvements in OHRQoL both immediately and in the longer term. These findings support those found by Healey et al., who observed a significant improvement in OHRQoL between completing orthodontic treatment and at the end of an extended post-treatment follow-up period (of a mean 21 months after appliance removal). The findings of the current study suggest that the benefits of orthodontic treatment manifest themselves in a shorter period (three months) following the removal of appliances. This may have implications for the timing of the capture of self-reported OHRQoL following the completion of orthodontic treatment. Several recent studies have issued questionnaires at the time of appliance removal⁷⁻⁹ and this may be too soon to allow the full benefits of the treatment to be realised. Previously reported studies may have underestimated the positive effects of orthodontic treatment. Longer periods after the removal of appliances may result in participants being lost to follow-up.⁷ Three months post-removal appears to be a convenient period to allow for supervision of retention and for the completion of self-reported OHRQoL questionnaires.

Conclusion

Post-orthodontic treatment OHRQoL outcomes for the three patient groups improved over a three-month period following orthodontic appliance removal. The use of self-reported measures should be delayed beyond the immediate time of appliance removal to allow the benefits of orthodontic treatment to be appreciated.

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