Does psychological well-being influence oral-health-related quality of life reports in children receiving orthodontic treatment?

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Introduction: Although the associations between oral biologic variables such as malocclusion and oral-health-related quality of life (OHRQOL) have been explored, little research has been done to address the influence of psychological characteristics on perceived OHRQOL. The aim of this study was to assess OHRQOL outcomes in orthodontics while controlling for individual psychological characteristics. We postulated that children with better psychological well-being (PWB) would experience fewer negative OHRQOL impacts, regardless of their orthodontic treatment status.

Methods: One hundred eighteen children (74 treatment and 44 on the waiting list), aged 11 to 14 years, seeking treatment at the orthodontic clinics at the University of Toronto, participated in this study. The child perception questionnaire (CPQ11-14) and the PWB subscale of the child health questionnaire were administered at baseline and follow-up. Occlusal changes were assessed by using the dental aesthetic index. A waiting-list comparison group was used to account for age-related effects.

Results: Although the treatment subjects had significantly better OHRQOL scores at follow-up, the results were significantly modified by each subject’s PWB status ($P < 0.01$). Furthermore, multivariate analysis showed that PWB contributed significantly to the variance in CPQ11-14 scores (26%). In contrast, the amount of variance explained by the treatment status alone was relatively small (9%).

Conclusions: The results of this study support the postulated mediator role of PWB when evaluating OHRQOL outcomes in children undergoing orthodontic treatment. Children with better PWB are, in general, more likely to report better OHRQOL regardless of their orthodontic treatment status. On the other hand, children with low PWB, who did not receive orthodontic treatment, experienced worse OHRQOL compared with those who received treatment. This suggests that children with low PWB can benefit from orthodontic treatment. Nonetheless, further work, with larger samples and longer follow-ups, is needed to confirm this finding and to improve our understanding of how other psychological factors relate to patients’ OHRQOL.

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As orthodontic outcome research continues to move away from the traditional biomedical model toward a biopsychosocial perspective, more attention is being given to the concept of oral-health-related quality of life (OHRQOL). OHRQOL is defined as the absence of negative impacts of oral conditions on social life and a positive sense of dentofacial self-confidence. Studies with reliable OHRQOL measures have identified differences between treated and untreated orthodontic patients. For example, a Brazilian study of 1675 adolescents indicated that children who had completed orthodontic treatment reported fewer OHRQOL impacts than those who were never treated. These differences were mostly related to socio-emotional aspects of well-being such as smiling, laughing, and showing teeth without embarrassment.

Such differences between treated and untreated subjects are expected in light of studies emphasizing the importance of dentofacial esthetics in daily social interactions. For instance, an unattractive dentition has been associated with teasing, bullying, and negative OHRQOL impacts. Improving dental esthetics and, subsequently, psychological well-being (PWB) are...
frequently stated reasons for seeking orthodontic treatment during childhood and adolescence. However, the bulk of evidence denoting the relative stability of PWB undermines this assumption. Furthermore, no studies have described how OHRQOL and PWB change during orthodontic treatment.

Attempts to correlate OHRQOL with clinical orthodontic indicators, on the other hand, have often reached equivocal conclusions. In many of these studies, children reporting worse OHRQOL were not consistently those with worse malocclusions. It is possible that some children with a severe malocclusion are more emotionally resilient to the challenges caused by their condition. Hence, accurate interpretation of OHRQOL measures requires an understanding of not only their psychometric properties, but also the contextual factors that might influence their assessments of health and well-being. A recent long-term study evaluating psychosocial outcomes in orthodontics suggested that analyzing the effects of orthodontic treatment on psychological health without considering intervening factors might lead to invalid conclusions about the efficacy of treatment. This was corroborated by cross-sectional reports recognizing the effects of innate personality traits on children’s perceptions of dentofacial esthetics and patients’ evaluations of the impact of their health on daily functioning.

Contemporary models of diseases and disorders and their consequences, which integrate both biologic and psychologic aspects of health, support this holistic thinking paradigm. For example, according to the model of Wilson and Cleary, health-related quality of life outcomes experienced by a patient are determined not only by the nature and severity of the disease or disorder, but also by the patient’s characteristics and his or her environment. A thorough examination of the orthodontic OHRQOL literature with the Wilson-Cleary model as the conceptual framework showed that, for the most part, studies have focused on the associations between biologic variables and OHRQOL, with little emphasis on the psychological characteristics of children receiving orthodontic treatment. This is surprising, since research has shown that determinants of health-related quality of life are mainly psychological. Hence, psychological factors such as PWB are certainly important mediators of OHRQOL.

Since the relationship between psychological factors and OHRQOL is largely unexamined in orthodontic patients, this study was undertaken to answer the question: do individual psychological characteristics affect children’s OHRQOL reports? The specific objectives of this longitudinal investigation were to explore the effect of PWB on reported OHRQOL in children receiving orthodontic treatment and to compare this effect with a sample of untreated waiting-list controls. We hypothesized that children with better PWB would experience fewer negative impacts, regardless of their orthodontic treatment status. According to this hypothesis, the children’s assessment of OHRQOL would be influenced by their PWB. To demonstrate this mediating role of PWB, we compared OHRQOL in children with high and low PWB scores. We expected that OHRQOL outcomes would not change for those in the high PWB group but might change for those in the low group.

Since medical research has shown that psychological variables are likely to affect the more subjective domains of quality of life reports, we expected that the influence of PWB would be more pronounced for the more subjective social and emotional dimensions of the OHRQOL measure used in this study than for the more objective dimensions addressing functional limitations and oral symptoms.

MATERIAL AND METHODS

In this study, we used a 2-group before-and-after design to assess changes in OHRQOL after orthodontic treatment. Patients receiving treatment were the focal group of interest, whereas patients awaiting treatment comprised the comparison group.

To be eligible, a child had to be fluent in English and have good general health. Children with severe dentofacial deformities were excluded. Parents’ consents and children’s assents were obtained, and the Research Ethics Board of the University of Toronto, Ontario, Canada, approved all study procedures. Subjects were not offered incentives or compensation for participating in the study. The treatment subjects were consecutively recruited from the graduate orthodontic clinic at the University of Toronto during their first assessment visit. The control subjects were consecutively recruited from the Faculty of Dentistry clinics during their first orthodontic screening visit. All 11- to 14-year-old subjects who met the eligibility criteria were recruited by the first author.

All children completed the child perception questionnaire (CPQ11-14) and the PWB subscale of the child health questionnaire at baseline (T1) and follow-up (T2). The questionnaires were completed by the children unassisted by parents or investigators. The dental aesthetic index (DAI) was used to determine the clinical severity of the malocclusion. Table 1 summarizes the main study variables. Age and sex were recorded because of their potential associations with outcome and explanatory variables. The treatments were completed at the graduate orthodontic clinic as routinely prescribed with
fixed appliance therapy. On average, treatment lasted for 26 months. The T2 data were collected at the first retention check appointment for the treatment subjects and after an equivalent time interval for the control subjects.

The CPQ11-14 is a child OHRQOL instrument. The age-specific questionnaire (11-14 years) consists of 37 items, grouped into 4 domains: oral symptoms (OS), functional limitations (FL), emotional well-being (EWB), and social well-being (SWB). Each item asks about the frequency of events, as applied to the teeth, lips, and jaws, in the previous 3 months. The response options were “never,” “once or twice,” “sometimes,” “often,” and “every day or almost every day.” Additive scale and subscale scores for the CPQ11-14 were calculated by summing the item response codes. Although the instrument was designed to yield an overall score, a separate score can be generated for each subscale. Higher scores signify worse OHRQOL. The validity, reliability, and responsiveness of this measure have been established in various settings.\(^5\)\(^,\)\(^21\)\(^,\)\(^23\)\(^,\)\(^33\)\(^,\)\(^39\)\(^-\)\(^42\) This measure examines the impacts of oral conditions on children’s EWB and SWB; nonetheless, it is important not to confuse these 2 domains with the more generic PWB. EWB and SWB focus specifically on the impacts of oral health conditions of children’s daily functioning, whereas PWB takes into account the effect of all aspects of health and daily life on well-being.

The children’s PWB was measured by using the PWB subdomain of the child health questionnaire, which is a widely used and validated self-report instrument.\(^43\) The 16-item PWB scale measures the frequency of both negative and positive feelings. The items capture anxiety, depression, and happiness. Frequency is measured by using a 5-level continuum that ranges from “all of the time” to “none of the time.” The scores were calculated according to the user’s manual.\(^44\) Higher scores indicate better PWB; a score of 100, for example, indicates that the child feels peaceful, happy, and calm all of the time. In contrast, lower scores indicate that the child has feelings of anxiety and depression. Specific instructions confirming the generic nature of the measure were added at the beginning of the questionnaire.

The severity of each treatment and control subjects’ orthodontic condition was assessed from study models taken at T1 and T2 and by using the DAI.\(^45\) Although other treatment-need indexes such as the index of orthodontic treatment need and the index of complexity, outcome, and need are available, the DAI was chosen because it incorporates the social acceptability of a child’s dental appearance. The rating is based on the measurement of 10 occlusal traits; each trait is multiplied by a weight derived from the judgment of laypersons. The products are summed, and a constant is added to give a DAI score. DAI scores range from 13 (the most acceptable) to 100 (the least acceptable). The DAI ratings were recorded by 3 trained and calibrated examiners. Intrarater and interrater reliabilities were evaluated by having the raters independently assess a random 10% sample of the models and then reassessing the models after a 1-week interval. Intrarater reliability for the DAI raters was high with intraclass correlation coefficients of 0.96, 0.91, and 0.97, respectively. The interrater reliability was also high (intraclass correlation coefficient of 0.81).

### Statistical analysis

The data were analyzed by using SPSS software (version 16, SPSS, Chicago, Ill). Data analyses included descriptive statistics, and bivariate and multivariate analyses. Paired t tests were used to assess within-group changes over time for the treatment and control groups. The P value for all tests was set at <0.05.

Analysis of covariance (ANCOVA) models were then used to explore between-group differences. The first goal was to evaluate the relationship between the provision of orthodontic treatment and the changes in OHRQOL, represented by overall and individual CPQ11-14 scores, while controlling for the CPQ11-14 scores at T1, age, and malocclusion severity. This analysis plan, represented in model 1 (Table II), aims to address whether there is a difference in reported OHRQOL between treatment and control subjects.

The second goal was to evaluate the role of PWB on mediating OHRQOL outcomes by using a second ANCOVA model (model 2 in Table II). This model addresses whether there is a difference in OHRQOL scores between treatment and control subjects and whether it remains significant after controlling for PWB.

### Table I. Main study variables and their interpretations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPQ11-14</td>
<td>Child perception questionnaire</td>
</tr>
<tr>
<td>OS</td>
<td>Oral symptoms</td>
</tr>
<tr>
<td>FL</td>
<td>Functional limitations</td>
</tr>
<tr>
<td>EWB</td>
<td>Emotional well-being</td>
</tr>
<tr>
<td>SWB</td>
<td>Social well-being</td>
</tr>
<tr>
<td>PWB</td>
<td>Psychological well-being</td>
</tr>
<tr>
<td>DAI</td>
<td>Dental aesthetic index</td>
</tr>
</tbody>
</table>

Lower CPQ11-14 scores represent better OHRQOL. Lower DAI scores represent better occlusion.
RESULTS

Of the 118 study subjects in this study, 50% were girls and 76% were white, with a mean age of 12.9 years (SD, 0.98) at T1. According to published DAI categories, 44.2% of the overall sample had handicapping malocclusions, 25.7% had severe malocclusions, 23.9% had definite malocclusions, and 6.2% had minor malocclusions.

Although follow-up data were successfully obtained from 118 subjects (74 treatment and 44 control), 199 children were recruited at the start of the study. To ensure that the relatively large percentage of dropouts (40.71%) did not compromise the comparability of T1 characteristics between the treatment and control groups, the data of the original and the retained subjects for the treatment and control groups were contrasted in Table II. The statistics indicated that all variables studied were comparable for both groups at T1. Hence, the subjects lost to follow-up did not influence the distribution of these variables.

Table II also summarizes the T2 data for the treatment and control subjects, with a guide to interpreting these scores in Table I. The CPQ11-14, EWB, SWB, and DAI scores for the treatment subjects were the only variables that changed significantly over the study period. In contrast, these scores did not change significantly for the control group. As expected, PWB scores remained relatively constant over time for both the treatment and control subjects. Furthermore, these PWB scores were slightly higher but not significantly different from those reported for normal schoolchildren.

As mentioned earlier, ANCOVA models were used to test the differences in reported OHRQOL between the treatment and control subjects. Treatment status was entered into the ANCOVA model as a fixed factor and tested for overall effect on CPQ11-14 overall and subscales scores at follow-up. For each scale, the first model controlled for age, T1 scores, and initial severity of malocclusion (DAI), and the second model also controlled for PWB. Table III provides a summary of the ANCOVA models and the total amount of variance explained by each model.

The results indicated a significant difference in overall CPQ11-14, SWB, and EWB scores between the treatment and control subjects (P <0.05). However, after considering PWB as a covariate, the effect of providing orthodontic treatment was no longer significant, as measured by the overall CPQ11-14 and SWB scores (P = 0.23). EWB was the only scale with the difference significantly reduced after controlling for clinical and psychological confounders. To illustrate the results, the adjusted mean CPQ11-14, SWB, and EWB scores for the treatment and control groups are presented in Table IV.

The contribution of DAI scores was not significant, with exception of the SWB subscale. DAI scores significantly contributed to the variance in SWB scores in both ANCOVA models. In addition, age effects were

### Table II. Main study variables at T1 and T2 for the treatment and control groups

<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>Original baseline</td>
<td>Retained baseline</td>
</tr>
<tr>
<td>Variable</td>
<td>Mean, (SD), range</td>
<td>Mean, (SD), range</td>
</tr>
<tr>
<td>CPQ11-14</td>
<td>21.05 (15.09)</td>
<td>21.63 (14.19)</td>
</tr>
<tr>
<td>OS</td>
<td>5.58 (3.40)</td>
<td>5.75 (3.37)</td>
</tr>
<tr>
<td>FL</td>
<td>5.09 (4.15)</td>
<td>5.27 (4.15)</td>
</tr>
<tr>
<td>EWB</td>
<td>5.19 (5.09)</td>
<td>5.29 (5.14)</td>
</tr>
<tr>
<td>SWB</td>
<td>5.18 (5.39)</td>
<td>5.32 (5.46)</td>
</tr>
<tr>
<td>PWB</td>
<td>80.66 (10.09)</td>
<td>79.78 (9.29)</td>
</tr>
<tr>
<td>DAI</td>
<td>34.21 (8.18)</td>
<td>33.72 (7.78)</td>
</tr>
</tbody>
</table>

*Paired t statistics significant at P <0.01.
the mode (76.6%), which approximates the population with an F ratio of 7.01 (in Table III). The results were statistically signifi-
cant, hence our results are timely, filling a research gap highlighted by many researchers. To the best of our knowledge, this is the first controlled longitudinal study evaluating OHRQOL outcomes of orthodontic treatment in light of pretreatment psychological attributes. These results support the postulated mediator role of PWB when evaluating OHRQOL outcomes in children receiving orthodontic treatment. The oral health impacts reported by our subjects were evident for the overall CPQ11-14, OS, and FL subscales. Nonetheless, these effects were apparent only after controlling for PWB. The mediating role of PWB was further examined by adding “group by PWB status” as an interaction term in a separate ANCOVA model (not included in Table III). The results were statistically significant with an F ratio of 7.01 (P < 0.01) and an adjusted R² of 26.8%. Since using normative reference groups is recommended by many researchers, we dichotomized PWB around the mode (76.6%), which approximates the population norms published by Landgraf and Abetz and others. We then examined the CPQ11-14 scores in the high and low PWB groups at T1 and T2. The direction of change was evaluated for both the treatment and the control subjects (Table V).

**DISCUSSION**

Although medical studies have stressed the importance of accounting for psychological parameters when quality of life is used as a primary outcome, a critical analysis of orthodontic psychosocial outcome research shows that most studies failed to do so. Hence, our results are timely, filling a research gap identified by many researchers. To the best of our knowledge, this is the first controlled longitudinal study evaluating OHRQOL outcomes of orthodontic treatment in light of pretreatment psychological attributes. These results support the postulated mediator role of PWB when evaluating OHRQOL outcomes in children receiving orthodontic treatment. The oral health impacts reported by our subjects were not entirely dependent on the associated clinical conditions. Rather, PWB influenced the participants’ perception of oral health problems to a significant degree. Children reporting better PWB were more likely to report better OHRQOL regardless of their treatment status. As hypothesized, the contribution of PWB to the variance in OHRQOL was considerably greater for the SWB and EWB subscales, compared with the OS and FL subscales (Table III).

The lack of significant changes in the PWB construct over the study period conforms to the hedonic treadmill theory, holding that well-being, for most people, is a relatively constant state. These data add to the bulk of evidence supporting this theory. The data also agree with other studies that invalidated the assumption that improving dental esthetics can have a significant effect on a child’s PWB.

This sample of Canadian children reported significant reductions in negative oral impacts after orthodontic treatment (mean CPQ11-14 reduction, 4.88; SD, 14.57) compared with control subjects of similar age, sex, and dental condition (mean CPQ11-14 reduction, 0.93; SD, 21.72). These results concur with other studies highlighting the positive effect of orthodontic treatment on OHRQOL. For instance, CPQ11-14 scores improved significantly after orthodontic treatment of children in Hong Kong. Similarly, de Oliveira and Sheiham, in a cross-sectional study of 1675 schoolchildren, found

**Table III. ANCOVA models showing contribution of covariates to overall and subscale (T2) CPQ11-14 scores**

<table>
<thead>
<tr>
<th>(T2) CPQ11-14</th>
<th>(T2) EWB</th>
<th>(T2) SWB</th>
<th>(T2) FL</th>
<th>(T2) OS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Model 2</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
</tbody>
</table>

**Table IV. Observed and adjusted mean (T2) CPQ11-14, EWB, and SWB scores**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Group</th>
<th>Mean (SD)</th>
<th>Mean (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPQ11-14</td>
<td>Treatment</td>
<td>16.16 (10.99)</td>
<td>17.93 (1.44)*</td>
</tr>
<tr>
<td>Control</td>
<td>23.14 (17.97)</td>
<td>20.89 (1.90)*</td>
<td></td>
</tr>
<tr>
<td>EWB</td>
<td>Treatment</td>
<td>2.51 (2.96)</td>
<td>2.99 (0.57)*</td>
</tr>
<tr>
<td>Control</td>
<td>6.82 (7.56)</td>
<td>6.16 (0.76)*</td>
<td></td>
</tr>
<tr>
<td>SWB</td>
<td>Treatment</td>
<td>3.03 (3.59)</td>
<td>3.48 (0.51)*</td>
</tr>
<tr>
<td>Control</td>
<td>5.29 (6.44)</td>
<td>4.50 (0.68)*</td>
<td></td>
</tr>
</tbody>
</table>

*Covariates appearing in the model were evaluated at the following values: CPQ11-14, 22.47; DAI, 34.56; PWB, 80.52; Covariates appearing in the model were evaluated at the following values: EWB, 5.70; DAI, 34.61; PWB, 80.43; Covariates appearing in the model were evaluated at the following values: SWB, 5.38; DAI, 34.61; PWB, 80.43.

Model 1 controls for age, DAI, baseline scores, and treatment status; model 2 controls for all variables in model 1 in addition to PWB status. *P < 0.05; **P < 0.01.
comparable treatment effects using other OHRQOL measures.

In-depth analysis of our data, however, showed that the effect of orthodontic treatment is less dramatic when viewed in the context of the children’s psychological profiles. The differences between the treatment and control subjects clearly diminished after accounting for PWB (Table IV). Results from the multivariate analyses showed that, for all scales, PWB explained additional variances in the dependent variables (overall and subscale CPQ11-14 scores). For example, the ANCOVA models accounting for PWB explained about a third of the variance in overall CPQ11-14 scores. The EWB subscale was the only scale to which the DAI scores made a significant contribution, making this subscale the closest to correspond to objective treatment needs.

The associations between psychological factors and perceived social and emotional impacts of oral health concurred with what has been previously reported for children, adolescents, and young adults.

Overall, our study emphasizes the extent to which psychological factors can modify children’s perceptions of their actual oral health status.

A closer examination of the items comprising each scale helps to explain these findings. The EWB subscale focuses on internal feelings such as being worried, embarrassed, or concerned about looks. In contrast, the SWB subscale consists of items assessing the impacts of malocclusion on various social interactions, including speaking in class, social activities, smiling, talking to other children, and teasing by other children. It is also important to consider that the data were collected shortly after the end of treatment. It is not surprising that orthodontic treatment did not have an immediate effect on children’s SWB. Children might simply need time to translate the emotional gains after treatment to their external environment. In general, the SWB and EWB findings concur with past studies documenting the negative effects of malocclusion on children’s lives.

In addition, treatment effects varied depending on the child’s PWB. In our study, children with high PWB scores were more likely to report significant improvement in OHRQOL after treatment, compared with those with low PWB scores (Table V). Evaluation of the overall sample suggests that there is a trend for CPQ11-14 scores to improve over time regardless of treatment status. Nevertheless, a closer evaluation of CPQ11-14 subscales demonstrated that treatment effects varied across the 4 subscales. The EWB subscale was the only one for which treatment effects remained significant after adjusting for other clinical and psychological factors. Conversely, the SWB subscale was the only scale to which the DAI scores made a significant contribution, making this subscale the closest to correspond to objective treatment needs.

### Table V. Mean T1 and T2 CPQ11-14 scores for the treatment and control groups based on PWB status

<table>
<thead>
<tr>
<th>PWB status*</th>
<th>Treatment status</th>
<th>Mean CPQ11-14 at T1, (SD), range</th>
<th>Mean CPQ11-14 at T2, (SD), range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low PWB</td>
<td>Treatment group (n = 23)</td>
<td>24.00 (12.77) 6.00-54.00</td>
<td>22.22 (11.16) 6.00-44.00</td>
</tr>
<tr>
<td></td>
<td>Control group (n = 19)</td>
<td>21.68 (14.67) 5.00-63.00</td>
<td>30.00 (20.97) 5.00-73.00</td>
</tr>
<tr>
<td>High PWB</td>
<td>Treatment group (n = 51)</td>
<td>20.88 (14.79) 3.00-58.00</td>
<td>14.69 (9.57) 3.00-39.00</td>
</tr>
<tr>
<td></td>
<td>Control group (n = 25)</td>
<td>25.88 (17.26) 3.00-80.00</td>
<td>17.92 (13.54) 2.00-51.00</td>
</tr>
</tbody>
</table>

*High PWB, ≥76.6; low PWB, <76.6 (PWB was dichotomized around the mode based on published population norms).
scores per PWB group (Table V) shows that children with low PWB who did not receive orthodontic treatment had worse CPQ11-14 scores over time than those who received treatment.

This change in behavior of the CPQ11-14 after accounting for the PWB status highlights the importance of considering the child’s psychological profile when evaluating OHRQOL outcomes in orthodontics. However, these results should be interpreted with caution because of the small sample size in each group. Nevertheless, the effect of PWB on reported OHRQOL is worth further investigation with larger samples and longer follow-ups.

Information generated from this study will be of great value to both clinical and policy-relevant research. Researchers interested in capturing the multi-dimensional aspects of oral health should consider the PWB of their subjects when designing their studies. Although some investigators might consider the PWB variable as “noise,” it might also be an important determinant of OHRQOL. Furthermore, the minor contribution of DAI scores to the variances in the CPQ11-14 scores demonstrates the limitations of clinical indicators in interpreting OHRQOL data.

Clinically, the results support the argument that orthodontists should include the psychological dimension in their assessment when prioritizing treatment needs and evaluating outcomes. Since children with low PWB scores appeared to suffer more impacts from their malocclusion, it seems logical to grant them priority for orthodontic care. This could be achieved by using proxy measures that reflect the children’s experiences, such as the self-reported CPQ11-14. Nevertheless, worse OHRQOL scores alone might not be sufficient to indicate clinically worse oral health. Further work is needed to refine existing OHRQOL measures to correspond more closely to objective health needs. For example, results from the CPQ11-14 subscale analyses can guide research to develop short forms of this measure intended for specific purposes.

There are some inherent limitations relevant to most studies of orthodontic treatment. Since randomization is difficult to achieve in orthodontics, a longitudinal observational design offered the best and most feasible alternative approach. Follow-up data confirmed our preliminary findings and established directionality between OHRQOL and PWB. The control group helped to draw conclusions related to treatment effects rather than changes stemming from the dynamic nature of psychological constructs in growing children. Despite the persistence of our recall efforts, this study was also limited by the relatively high attrition rate. This was mostly because some waiting-list patients sought alternative care or relocated outside the city. Although it is possible to assume that those who sought alternative treatment were those with worse malocclusion or worse PWB, the distribution of the main T1 characteristics between the original and the retained subjects was comparable, at least for the variables measured (Table II). Nevertheless, the ANCOVA results should be interpreted with caution, especially considering the lack of randomization and the observational nature of this study.

It is important to reconsider the current biomedical and restricted paradigm on OHRQOL and to begin to think about the series of processes by which social and psychological factors influence OHRQOL reports. This study lays the ground for developing a conceptual understanding of the interaction between reported OHRQOL and a patient’s PWB. Although PWB explained the variance in CPQ11-14 to a reasonable extent, the lack of comparable studies in the literature makes it difficult to generalize the findings. Furthermore, the relatively low $R^2$ values associated with the models indicated that there could be other determinants of OHRQOL. For instance, the direct contribution of factors such as other oral health problems, social support, and personality traits was not assessed in this investigation. Hence, further work should be attempted to study these factors with larger samples, different age groups, and longer follow-ups to improve the quantity and quality of orthodontic OHRQOL data. The use of complex structural equation modeling or path analysis can also add to our understanding of how the various aspects of psychological health relate to patients’ OHRQOL. Thus, an impetus for further meaningful OHRQOL research in orthodontics will be provided.

CONCLUSIONS

The findings of this study highlight the importance of considering inherent psychological parameters in orthodontic psychosocial research. More specifically, the results support the mediator role of PWB when evaluating OHRQOL outcomes in children with a malocclusion. Children with better PWB are, in general, more likely to report better OHRQOL regardless of their orthodontic treatment status. On the other hand, children with low PWB, who did not receive orthodontic treatment, experienced worse OHRQOL, compared with those who received treatment. This suggests that children with low PWB might benefit from orthodontic treatment, but further work, with larger samples and longer follow-ups, is needed to confirm this finding and to improve our understanding of how other psychological factors relate to patients’ OHRQOL.
The author would like to acknowledge the orthodontic residents and staff at the university of Toronto for their help with this study.

REFERENCES


