Does Orthodontic Treatment Affect Patients' Quality of Life?

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Abstract: The oral-facial region is usually an area of significant concern for the individual because it draws the most attention from other people in interpersonal interactions and is the primary source of vocal, physical, and emotional communication. As a result, patients who seek orthodontic treatment are concerned with improving their appearance and social acceptance, often more than they are with improving their oral function or health. Enhancing these aspects of quality of life is an important motive for undergoing orthodontic treatment. Regardless of age, patients' and their parents' or caregivers' expectations about improvements in oral function, esthetics, social acceptance, and body image are important for both general dentists and orthodontists to consider when advising patients about these procedures and during the treatment process. This review of research on the impact of conventional and surgical orthodontics on quality of life examines the association between oral health-related quality of life and severity and type of malocclusion, as well as the impact of treatment and patient characteristics on quality of life. The article will emphasize the importance of clinicians' having a clear understanding, *before* initiating treatment, of their patients' quality of life and their expectations about improvements in specific domains of quality of life.

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Over the past decade, the impact of oral health and disease, dental appearance, malocclusion, and treatment for these conditions on psychological and functional well-being has drawn increasing attention from clinicians and researchers. Indeed, a recent issue of *Seminars in Orthodontics* (2007) was dedicated to the topic of quality of care and quality of life associated with malocclusion and its treatment. The general construct of quality of life originated in the field of general medicine and has been defined as "people's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns"[1] or, more simply, as "a sense of well-being that stems from satisfaction or dissatisfaction with areas of life that are important" to the individual.[2] The more specific concept of "oral health-related quality of life" has been defined as "a standard of health of oral and related tissues which enables an individual to eat, speak, and socialize without active disease, discomfort, or embarrassment"[3] or "the absence of negative impacts of oral conditions on social life and a positive sense of dentofacial self-confidence."[4]

The following review of research on the impact of malocclusion and its treatment on oral health-related quality of life (OHRQoL) will examine the evidence for and against this association. Studies that have tested the link between OHRQoL domains and the severity, type, and treatment of malocclusion will be discussed, as well as characteristics of the individual that may influence these associations.

OHRQoL is generally assessed subjectively, although some researchers have discussed the feasibility of parents' reporting this for children younger than age ten. In general, parents underestimate the impact of oral conditions on their children's emotional and social quality of life. However, there is greater agreement between parents and children in observable aspects of quality of life, such as physical functioning.[5]

Impact of Orthodontic Treatment on OHRQoL

Several studies have examined how orthodontic treatment affects OHRQoL. Most researchers have found differences between treated and untreated patients, but scores tend to be skewed toward favorable quality of life, even among patients with severe malocclusion. In a study of 1,675 adolescents in Brazil, researchers administered two OHRQoL scales and assessed malocclusion with an objective measure, the Index of Orthodontic Treatment Need (IOTN).[6] Youths who had completed orthodontic treatment reported fewer oral health impacts than their peers who were currently under treatment (1.85 times less) and fewer than those who were never treated

(1.43 times less). Significant differences emerged in three areas related to socioemotional well-being: smiling, laughing, and showing teeth without embarrassment.

Youths with high clinical need (using the IOTN) reported 2.65 times more dental impacts on the OHRQoL measures than did children with lower need. Children with acceptable or ideal occlusion and their parents reported higher OHRQoL than those with any degree of malocclusion, specifically children who had increased overjet (>6 mm) or anterior spacing greater than 1.5 mm between adjacent teeth.[7] To date, no differences have been found between types of malocclusion.[7,8]

It is noteworthy that OHRQoL scales that measure different components of this concept have found differences between children with malocclusion vs. acceptable occlusion on emotional and social well-being, but *not* on oral symptoms and functional limitations.[8] It is therefore not surprising that scores on the oral function domain of OHRQoL do not improve dramatically with orthodontic treatment. Indeed, this lack of perceived improvement in oral function appears to be an objectively verifiable outcome; a recent review of the impact of malocclusion and its treatment on several areas of quality of life concluded that conventional orthodontics without surgery generally does not improve patients' chewing efficiency or self-reported masticatory ability. Nor does it affect objectively assessed speech articulation.[9] Currently, the most widely used measure of OHRQoL in children is the Child Oral Health Quality of Life Questionnaire (COHQOL).[10,11] It was developed for the express purpose of assessing OHRQoL outcomes related to clinical trials and intervention studies among children ages six to fourteen. It includes a Parental-Caregiver Perceptions Questionnaire (P-CPQ), to obtain parents' proxy ratings of their children's OHRQoL, and the Child Perceptions Questionnaire (CPQ). The latter has slightly different questions in the forms designed for ages six to seven, eight to ten, and eleven to fourteen. The $CPQ_{11\text{-}14}$ form, for example, is comprised of thirty-six items that represent four health domains: oral symptoms, functional limitations, emotional well-being, and social well-being.

Several measures of OHRQoL have been developed for adult populations. Most of these grew out of studies that focused on the impact of caries, periodontal disease, and tooth loss and replacement among older adults. These include the General (formerly "Geriatric") Oral Health Assessment Index (GOHAI)[12,13] and the Oral Health Impact Profile (OHIP).[14] The latter has been widely used and validated with diverse populations and in multiple languages. A shortened version of this scale (OHIP-14) contains all the original domains represented by the original forty-nine-item scale (e.g., physical pain, social disability, psychological discomfort, functional limitations) and has increasingly been applied to studies on the impact of dental conditions and their treatment among adults.[15-17]

Researchers in New Zealand assessed the association between OHRQoL and malocclusion severity among 430 children ages twelve to thirteen who varied in their extent of malocclusion.[18] Using the Child Perceptions Questionnaire for eleven- to fourteen-year-olds ($CPQ_{11\text{-}14}$), described above, the researchers observed a distinct OHRQoL gradient, with children in the "handicapping" category of malocclusion obtaining the highest (worst OHRQoL) scores and those in the "minor/no malocclusion" category scoring best. However, these differences emerged only on the emotional and social well-being domains (e.g., worrying about being different, being teased, avoiding smiling), *not* in oral symptoms or functional limitations (e.g., pain, difficulty chewing).

Consistent with these findings, a study of young adults in Florida who had or had not undergone orthodontics in the past ten years found that those with lower Peer Assessment Ratings of occlusion (PAR) scores (i.e., better occlusion) reported higher OHRQoL, using another measure of this concept for adults,[19] in the areas of appearance ($r=-.21$, $p<.005$) and performance ($r=-.25$, $p<.005$), but less so in eating ($r=-.17$, $p<.05$). These patterns were more prominent in the untreated group, such that young adults with malocclusion who had not received orthodontic treatment reported lower oral health-related quality of life in several domains.[20] This is consistent with the findings of the study of Brazilian youths.[6]

Patient Expectations for OHRQoL and Demographic Comparisons

It appears that improved appearance and psychosocial function are important OHRQoL concerns for patients who seek orthodontic treatment.[21] Among young adults in Finland, the primary motives for orthodontic treatment were to improve dental appearance and attitudes toward malocclusion, not necessarily

oral function.[22] In another study, researchers followed 197 adolescent orthodontic patients at the University of Hong Kong from pretreatment through six months of fixed-appliance therapy.[23] Despite children's expectations of functional, emotional, and social problems during the course of treatment, these CPQ domains actually improved during the first six months of active orthodontic therapy. The authors did not measure post-treatment OHRQoL.

Patients ages eight to fourteen expect significant improvements in their social and psychological well-being and in their oral function, but less so in their general health. Parents consistently expect more improvement than their children in all domains. Ethnic differences have emerged, with non-Hispanic white children and their parents expecting greater improvement in appearance than other ethnic groups. Latino and African American children report higher expectations for improved social acceptance following treatment, and all three ethnic groups expect moderate levels of improvement in their oral function.[24-26] These findings suggest that children from diverse ethnic groups can benefit from orthodontic treatment, but it is important for dental providers to determine individual and ethnic differences in treatment expectations. These studies also demonstrate that, contrary to popular stereotypes, boys and girls do not differ in their expectations for improved appearance as a result of orthodontic treatment although, in these same studies of children anticipating interceptive treatment in the mixed dentition, girls reported significantly greater social expectations.

However, gender differences cannot always be predicted accurately. A comparison of three children anticipating interceptive orthodontics illustrates the importance of examining each patient's perceptions and expectations.[27] The children in Figures 1–3 all qualified for orthodontic treatment under Medicaid because of severe overjet (12 mm, 14 mm, 13 mm, respectively). All had anterior crowding. The girl in Figure 1 (age ten years and four months) also had a 3 mm overbite and lip incompetence. The boy in Figure 2 (age eight years and seven months) had an openbite, while the boy in Figure 3 (age eight years and ten months) had a 5 mm overbite. Despite their remarkable similarities in objective indicators of malocclusion (i.e., severe overjet, anterior crowding, overbite, or open bite), these children differed in their treatment expectations. Most different was the girl in Figure 1, who reported high expectations

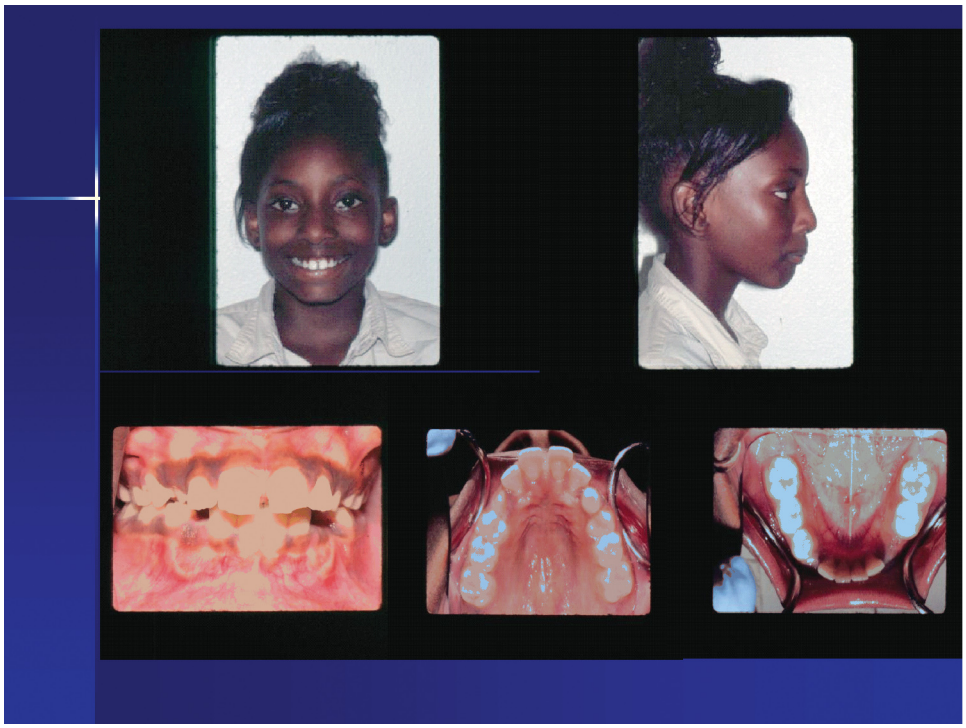

Figure 1. Child (age ten years and four months) anticipating interceptive orthodontics

Figure 2. Child (age eight years and seven months) anticipating interceptive orthodontics

Figure 3. Child (age eight years and ten months) anticipating interceptive orthodontics

Table 1. Interceptive pre-treatment expectations vs. post-treatment experiences

	Child Self-Rating†	Parent Rating†
Pre-Treatment Expectations		
Oral function	6.6 (4.5)	9.1 (2.7)
Appearance	6.3 (4.2)	9.0 (2.7)
Health	1.6 (2.1)	2.1 (2.2)
Social	5.8 (4.9)	8.0 (4.1)
Post-Treatment Experiences		
Oral function	6.1 (3.7)	6.0 (3.7)**
Appearance	5.7 (3.7)*	6.7 (3.7)*
Health	0.6 (1.4)*	0.6 (1.4)*
Social	4.2 (3.8)*	5.5 (3.7)**

Scoring for Expectations/Experiences: -12 (much worse after orthodontics) to +12 (much better after orthodontics)

†Mean scores (SD)
*Change from pre- to post-treatment: p<.05
**Change from pre- to post-treatment: p<.01

Source: King GJ. Early orthodontic intervention under Medicaid. NIDCR Disparities Center grant #P54 DE14254, University of Washington. Report to DSMB, May 2007.

for improved oral function but much lower expectations in the other domains. In contrast, the boy in Figure 2 reported highest expectations for improved appearance and low in other domains. The third child had high expectations for improved appearance and social function, but low for oral function; this boy's expectations were diametrically opposite from what we found for the girl with similar treatment needs.

Our findings and those of other researchers suggest that both boys and girls, as well as their parents, expect orthodontics to enhance their lives in many ways beyond just improving occlusion, mastication, and speech. Both the children and their parents view this treatment as a means to achieving a better quality of life. For this reason, the correction of malocclusion takes on a more dramatic psychological and social significance than one expects from routine dental procedures such as restorations.

In a series of studies examining children and adults undergoing conventional and surgical orthodontics, we have consistently found expectations for improved social acceptance and esthetics to be as high as or higher than oral function expectations. However, post-treatment self-reports generally reveal greater satisfaction with esthetic and oral function outcomes than with social outcomes.[26,27] Findings from our ongoing study of children undergoing interceptive orthodontics funded by Medicaid illustrate this pattern among children and their parents (see Table 1).[27]

Patient concerns with esthetics and social acceptance may not be surprising in light of the social stigma faced by individuals whose appearance is outside the norm, even if they do not have craniofacial anomalies. In particular, children with visible malocclusions are often teased and socially ostracized. Such emphasis on the attractiveness of teeth and the mouth is consistent with research demonstrating that, in social interactions, the listener's attention is mainly directed toward the mouth and eyes of the speaker.[28]

The possibility that this emphasis on esthetics is a universal phenomenon is supported by a study of patients aged nine through twenty who were seeking orthodontic treatment at a university clinic in Amsterdam. The researchers found that older teens and young adults expected greater improvement in their appearance than did adolescent patients, but no age differences emerged in concerns about functional problems. Indeed, these youths did not expect their oral function to improve as much as their general health and appearance. Dissatisfaction with one's dental appearance was the best predictor of expectations in the areas of improved appearance and dental health among the young adults in this sample, but dissatisfaction with their facial appearance in general did not predict treatment expectations.[29]

This review of studies that have assessed ethnic, gender, and age differences in OHRQoL expectations reveals that improved esthetics or appearance is a greater motive for young patients than improvements in oral function. While some ethnic and gender differences exist in OHRQoL expectations, there is a consistent pattern of expecting greater improvement in esthetics and social acceptance than in oral function among both children and their parents.

Esthetics as a Component of OHRQoL

Facial and dental attractiveness represents an important element of quality of life for patients seeking orthodontic treatment. Indeed, the review of OHRQoL studies in the previous section demon-

strates that the socioemotional domain of quality of life (smiling, showing teeth without embarrassment, being teased about appearance) plays a significant role in the decision to undergo conventional or surgical orthodontics and is recognized by the orthodontist as a primary benefit of treatment.[30]

Researchers have consistently found that facial attractiveness affects interpersonal success, particularly in school and employment settings. Attractive children and adults generally receive more favorable judgments and academic and performance reviews than do unattractive individuals. This in turn results in greater self-confidence among those high in attractiveness.[31] The appearance of teeth and the smile are critical components of facial attractiveness.[28,32] The media and society in general reinforce this message that "beauty is good." Movie and television heroes have attractive teeth, in contrast to villains with crooked and discolored teeth. Models in television and magazine ads often display teeth that are not only perfectly aligned but also bleached and with ideal proportions. Not surprisingly, these popular images can generate self-criticism and dissatisfaction in the general population, especially among adolescents.[33,34]

This may be one reason why patients' primary area of concern regarding their body image is their teeth and, to a lesser extent, their mouth. Using a body image scale expanded from one introduced by Secord and Jourard,[35] we have found a consistent pattern of moderate to high satisfaction with other parts of the body, but much lower self-ratings of the face among patients seeking conventional or surgical orthodontics. There is a striking difference between patients' satisfaction with their faces as opposed to other parts of their bodies when assessed before they undergo treatment. This is particularly true for self-ratings of teeth and mouth appearance among both children and adults who seek conventional and surgical orthodontics. The latter are more critical about their facial profile as well. Even among children as young as age eight or nine, self-consciousness about the appearance of their teeth is striking, in contrast to satisfaction with their overall body image and moderate acceptance of their facial appearance in general.

Following treatment with fixed appliances or after combined orthodontic/surgical procedures, patients report significant improvements in these body-image domains, but only slight or no change in other body components because their self-ratings in these other areas remain high.[25,27,36,37] As shown in Table 2, significant changes in facial image were observed from pre- to post-orthodontic therapy among children undergoing interceptive treatment in the mixed dentition, but not in overall body image.[27] In fact, self-ratings of teeth appearance improved to the level of other body features after orthodontic treatment. In a follow-up of young adults who had undergone one- or two-phase treatment five to ten years earlier and their peers who never received treatment, the "teeth" component of body image was higher in the two treatment groups ($p<.001$) than among untreated volunteers. However, the groups did not differ on other body image items.[20]

Table 2. Body image scores pre- and post-interceptive orthodontic treatment

	Mean Score (SD)
Pre-Treatment Self-Rating	
Total body image	3.6 (0.7)
Subscores	
Facial image	3.5 (0.7)
Facial profile	3.7 (1.1)
Teeth	2.2 (1.5)
Post-Treatment Self-Rating	
Total body image	3.7 (0.6)
Subscores	
Facial image	3.8 (0.6)*
Facial profile	3.8 (0.8)
Teeth	3.6 (1.4)**

Scores: 1="Wish I could change" to 5="I feel very fortunate"

*Change from pre- to post-treatment: $p<.05$
**Change from pre- to post-treatment: $p<.01$

Source: King GJ. Early orthodontic intervention under Medicaid. NIDCR Disparities Center grant #P54 DE14254, University of Washington. Report to DSMB, May 2007.

Perceived Treatment Need vs. OHRQoL

Several studies provide evidence that lower OHRQoL related to malocclusion does not necessarily translate into greater perceived need for orthodontic treatment. Researchers in the United Kingdom administered the CPQ and the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN) to 174 untreated children ages ten to twelve.[38] Dentist examiners completed all components of the IOTN. Self-reports on the AC were more negative than dentist ratings, but only 35 percent of children

who rated their AC in the negative range wanted to undergo orthodontic treatment and only 46 percent indicated they would be upset if they could not obtain treatment. The researchers found a low but significant correlation between the CPQ and self-rated AC (rho=0.184), but dentist ratings on the IOTN were unrelated to children's CPQ scores. This underscores the importance of asking children directly to rate their dental esthetics and the impact of their malocclusion on their quality of life, rather than the orthodontist or general dentist making assumptions about what is best for the child. As demonstrated in this study, low self-reported OHRQoL does not always imply a greater desire for treatment.

Researchers in Norway also administered the Aesthetic Component (AC) of the IOTN to children, in this case 359 children in Bergen schools (mean age 10.6) who had not undergone orthodontic treatment.[39] Study models were scored by orthodontists using the AC and the Dental Health Component (DHC) of the IOTN. In contrast to the findings by Kok et al. in the UK,[38] these children rated themselves significantly more favorably on the AC than did orthodontists ($p<.05$). However, both studies found that children with the worst malocclusion (Grade 5 on the DHC) were not always concerned about their condition. In the Norwegian sample, 52.4 percent of children with DHC Grade 5 and 46.5 percent in DHC Grade 4 expressed no cares about their status. Parents were far more likely to express concerns about their child's malocclusion: 68 percent of those whose children had been rated 4 or 5 on the DHC indicated that they were concerned. These findings highlight the importance of assessing children's perceptions of their dental esthetics, quality of life, and treatment needs separately from that of their parents or orthodontist or general dentist.

It is also useful to understand the perceptions of general dentists compared to orthodontists regarding the benefits of treatment, since the former are often the first to assess and refer patients to orthodontists. A study of 139 general dentists and twenty-eight orthodontists in Northern Ireland found low concordance in ratings of the benefits of orthodontic treatment.[30] The top five benefits were consistent between the two groups: physical attractiveness, self-esteem, self-confidence, less teasing, and easier-to-clean teeth. However, general dentists attributed more oral health and functional benefits to orthodontic treatment than did specialists, who focused on the psychosocial benefits of treatment. It appears that orthodontists' beliefs about the benefits of this treatment are more consistent with the beliefs of patients themselves.

As illustrated by several studies described in this review, the primary area of OHRQoL that patients seeking orthodontics are trying to improve is psychosocial, especially dental and facial appearance. Well-aligned teeth and an attractive smile are important to laypersons, perhaps more valued than improved oral function. This is probably good for the profession because evidence-based claims for the oral health benefits of orthodontic treatment, particularly its preventive effects, are not strong. Indeed, a recent review of frequent claims that orthodontics can reduce susceptibility to dental caries, periodontal disease, temporomandibular disorders, and traumatic dental injuries are not supported by careful longitudinal studies of individuals who do or do not obtain orthodontic treatment.[40]

However, psychological benefits may also be less dramatic than generally assumed. A twenty-year observational study of 332 individuals (45 percent of whom obtained orthodontic treatment on their own during this period) between 1981 and 2001 who were between the ages of eleven and twelve at baseline found that self-esteem did not improve when baseline level of self-esteem was controlled, nor were untreated persons more likely than those who underwent orthodontic treatment to experience psychological disorders such as depression or social anxiety.[41] However, those who had significant malocclusion and underwent orthodontic treatment during that period reported greater satisfaction with their dental occlusion and with their dental and general appearance. These patients also reported higher overall quality of life in their twenty-year assessment, compared with their peers who also had significant treatment needs but had not undergone treatment.

Conclusions

This review of the impact of malocclusion and its treatment on OHRQoL provides several consistent findings. There is ample evidence that patients focus primarily on esthetic and social aspects of OHRQoL as a motive for seeking orthodontic treatment; this is true for children as young as age eight and for adult patients. For the most part, patients with severe malocclusion appear to have poorer OHRQoL than patients with less critical treatment need in these domains, but not in OHRQoL related to oral function. The type of malocclusion (e.g., whether it is an

overjet or overbite) does not affect patients' OHRQoL as much as its severity or visibility. It should also be noted that individuals who rate themselves negatively on OHRQoL do not always want or seek treatment.

Undergoing orthodontic intervention has been found to enhance some aspects of OHRQoL, particularly esthetics, but not necessarily social acceptance. Psychological well-being as represented by self-esteem does not appear to be significantly affected over the long term. For most patients, treatment also does not have a significant salutary effect on objectively or subjectively assessed oral health status. A recent query of a potential patient to an orthodontist illustrates the dilemma faced by individuals who are referred by general dentists for preventive reasons: "My hygienist comments on my need for braces every time I come in, and with my old age creeping in, I don't want to wait until it's too late and damage my teeth, if I haven't [done so] already."

These findings suggest that general dentists and orthodontists must communicate clearly with their patients about the pros and cons of orthodontic treatment, determine if a patient wants to undergo such treatment, and assess whether the expected benefits are realistic. The evidence from the available OHRQoL research suggests that esthetic and functional improvement is realistic, but the patient should not anticipate that treatment will enhance their self-esteem or prevent future caries, periodontal disease, or temporomandibular disorder (TMD). It behooves the general dentist and orthodontist to listen carefully to each patient's understanding of his or her malocclusion and its impact on quality of life domains, including oral function, appearance, social acceptance, and emotional well-being. Only then can the process of patient education and informed consent be successfully completed.

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