

**The Change in Oral Health Related-Quality of Life among Adolescents and Their
Families after Orthodontic Treatment**

By

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Abstract

The Change in Oral Health-Related Quality of Life among Adolescents and their Families after Orthodontic Treatment

Objective: Assess the changes in oral health-related quality of life (OHRQoL) of adolescents and their parents after overjet reduction.

Materials and Methods: 53 patients between the ages of 11-18 years with increased dental overjet ($\geq 6\text{mm}$) and their parents were selected, of which 28 were pre- and 25 were post-treatment with dental overjet reduced to within normal limits. The data collection instrument was the Child Oral Health Quality of Life (COHQoL) Questionnaire.

Results: Adolescents and their parents reported poorer quality of life before orthodontic treatment than after. The improvement in oral health-related quality of life was statistically significant for all health domains except for the social well-being domain. Parental reports on (OHRQoL) were in agreement with their children's. No statistically significant differences were evident in (OHRQoL) between pre- and post-treatment groups.

Conclusions: Adolescents with increased dental overjet $\geq 6\text{mm}$ experienced substantial psychosocial impacts. Adolescents with increased overjet can accurately recall the initial negative effects of the original malocclusion on their lives, even after a time lapse of five years. Orthodontic treatment significantly improves the perceived quality of life of orthodontic patients and their parents.

Key Words: oral health-related quality of life questionnaire, orthodontic treatment, overjet, adolescents, parents.

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Chapter 1

Introduction and Literature Review

Introduction

Physical appearance can influence an individual's personal life and social acceptance. In interpersonal interactions, the oral and dental structures draw the most attention from others because they are the source of vocal and emotional communication (Kiyak, 2008a). A number of studies have demonstrated the physical, social, and psychological effects of untreated malocclusions (DiBiase & Sandler, 2001). The negative effects of malocclusion can take on a significant psychological impact on the evolving personalities and social skills of children and adolescents. Children with visible malocclusions are often teased and socially challenged by their peers (Shaw, Meek, & Jones, 1980). Visible dental differences, such as crowding, spacing, and increased overjet, are usually associated with high levels of dissatisfaction with appearance and negative impact on children's overall oral health related quality of life (Rodd, Marshman, Porritt, Bradbury, & Baker, 2011b). Moreover, significant relationships exist between low self-esteem and certain occlusal traits such as Class II Division 1 incisor relationship and increased dental overbite (Seehra, Fleming, Newton, & DiBiase, 2011).

Unpleasant teeth arrangement such as an increased overjet and a spaced dentition were found to have a significant negative impact on both the children's and their families' quality of life (Johal, Cheung, & Marcene, 2007). However, the difference in the patients' quality of life that is brought about by orthodontic treatment was not adequately assessed in previous studies. Thus, the aim of the present study was to assess the change in oral health related quality of life of adolescents and their parents after orthodontic correction of increased dental overjet to within normal limits.

Background

Factors affecting patients' expectations for their oral health and esthetics

An adolescent expects that he/she will be able to eat, speak, and socialize without active disease, discomfort, and embarrassment. Any shortfall between the individual's ideal and the perceived expectations, result in discontentment and a desire for improvement. Recently, it has been suggested that various factors may play a role in shaping adolescents' satisfaction, or lack of, with their dental appearance and thus their desire to proceed with orthodontic treatment for cosmetic reasons (Kiyak, 2008a). Discontent with one's dental appearance, suggestion from a dentist, concern on the part of parents, and the influence of classmates who had braces are among the main factors directly involved in the demand for orthodontic treatment (Marques et al., 2009).

Psychological studies suggested that most children and adolescents worldwide developed a bicultural identity that combines their local identity which is based on their social and ethnic backgrounds with an identity attributed to the global culture as a result of media exposure and globalization (Arnett, 2002). The media exposure was found to affect adolescents' self-image and their perceived need for braces, for example subjects aged 11- 14 who admitted to watching more than 2 hours of television were more critical in judging their own dentitions (Ahmed, Gilthorpe, & Bedi, 2001). Another example is that protruding incisors are judged unattractive within populations where most individuals have prominent teeth, such as black Americans, just as they are within less protrusive groups (Farrow, Zarrinnia, & Azizi, 1993).

A study conducted in the UK revealed that Grade 5 in the Aesthetic Component (AC) scale of the Index of Orthodontic Treatment Need (IOTN) represents the threshold of dental aesthetic impairment where orthodontic treatment should be sought, as judged by clinicians and multiethnic school children (Ahmed et al., 2001). The (AC) scale is composed of 10 colour

photographs showing different levels of dental attractiveness where the observer is meant to score the severity of the malocclusion in comparison with the image scale. The most unpleasant teeth arrangement receives the highest grade. For example, Grade 5 in the (AC) corresponds to deep bite and maxillary midline diastema, whereas Grade 7 and Grade 9 correspond to increased dental overjet (Ahmed et al., 2001). The findings from Ahmed and coworkers (2001) study imply that the appearance of protruding teeth is not tolerated by adolescents because it falls two grades beyond the range of aesthetic acceptability on the (AC) scale. Another study conducted in the UK found that a sample of dental patients who visited the dentist every 6 months were more likely to choose a threshold photograph closer to the attractive end of the scale than those who visited their dentist less frequently (Hunt, Hepper, Johnston, Stevenson, & Burden, 2002).

Factors motivating patients and their parents to seek orthodontic treatment

The perceived need and subsequently the desire for braces are sensitive to several cultural factors. Children from an ethnic minority had a wider range of aesthetic acceptability than Caucasian children, when asked to rate faces with crowded teeth, overbite, and diastema (Tung & Kiyak, 1998).

A recent Polish study designed to investigate patients' motivation for seeking orthodontic treatment, assessed two groups; 674 children aged 7-18 years and their parents/guardians and 86 adult patients aged 19-42 years. The study demonstrated that improvement in dental aesthetics was the principle motivational factor for the children (29 to 48 per cent), their parents/guardians (54 per cent), and adult patients (55 per cent) for seeking orthodontic treatment. Interestingly, less than 5 per cent of subjects started treatment because other

children made fun of them, and only 3 per cent of older patients were motivated by future improvements in health (Wedrychowska-Szulc & Syrynska, 2010).

A self-completion questionnaire survey study conducted in the UK to determine patients' and parents'/guardians' motivation for orthodontic treatment assessed 330 new orthodontic patients, half of which were between 11 and 13 year-old, found that most of the patients (87%) were concerned with the appearance of their teeth and significant number (38%) reported teasing related to their dental appearance. In 81% of cases, the dentist initiated the referral for orthodontic treatment and only 20% of subjects thought there was nothing wrong with their teeth (Fleming, Proczek, & DiBiase, 2008).

Early stages of psychological development can influence the child's motive for orthodontic treatment, as well as his/her understanding of, and adherence to treatment regimens (Tung & Kiyak, 1998). When asked about motives and expectation of orthodontic treatment, both children and their parents expected the most improvement in self-image and oral function, with greater expectations by parents on self-image, oral function, and social life than children themselves (Tung & Kiyak, 1998).

Based on the reviewed studies, the enhancement of physical, social and psychological well-being is the key reason why orthodontic care is sought and therefore it can be argued that the best measure of outcome from orthodontic treatment is the improvement in these aspects.

Literature review

Prevalence of malocclusion

High prevalence of malocclusions has been reported in different parts of the world across different ethnic groups, age groups, and methods of registration. Several studies which evaluated different populations reported 92% (Abu Alhaija, Al-Khateeb, & Al-Nimri, 2005), 74.2% (Martins Mda & Lima, 2009), and 91% (Murshid, Amin, & Al-Nowaiser, 2010) as overall prevalence of various malocclusion anomalies.

Malocclusion traits detected in 13-15-year-old North Jordanian school children were crowding (50.4%), midline shift (31.7%), spaced dentition (26.7%), increased overjet (24.7%), deepbite (16.9%), crossbite (6.8), median diastema (6.9%), missing teeth (6%), openbite (2.9%), and reversed overjet (1.9%) (Abu Alhaija et al., 2005). Whereas in sample of Brazilian schoolchildren aged 10 to 12 years, the dental crowding was observed in 62.5% and the presence of midline diastema was observed in 14.8% of the school children (Martins Mda & Lima, 2009).

A study conducted to assess the distribution of occlusal anomalies in a sample of 1,024 adolescents aged 13-14 years in Jeddah city, Saudi Arabia revealed that post-normal occlusion, pre-normal occlusion and bimaxillary protrusion represented 21%, 15% and 8% of the studied sample respectively. Moderate and severe overjet accounted for 24% and 5%, respectively. Moderate and severe overbite accounted for 27% & 13%, respectively. Midline deviation was detected in 24% of the students. Severe maxillary and mandibular dental crowding represented 4% and 9%, respectively. Only 9% of the examined adolescents had normal occlusion (Murshid et al., 2010). The reviewed studies showed that malocclusion is one of the most common oral disorders and its prevalence is high in most countries. Moreover, malocclusion traits remain

remarkably stable if patients do not receive orthodontic treatment (Helm, Kreiborg, & Solow, 1985a). Greater understanding of the physical, social and psychological effects of malocclusion is essential because it provides an insight into the consequences of malocclusion on orthodontic patients' lives {{144 Zhang,M. 2006}}.

Physical impact of malocclusion on oral health and function

Different malocclusion traits have been reported to have several physical effects on subjects' oral health and function. For instance, it has been reported in the dental literature that subjects with Class III malocclusions have the poorest masticatory efficiency and ability, followed by those with Class II and Class I malocclusions, respectively (English, Buschang, & Throckmorton, 2002). Findings from longitudinal studies suggest that there is a significant but weak association between speech disorder and malocclusion, for example patients with a large overjet and deep bite pronounce sibilants such as /s/, /z/, and /ch/ differently (Laine, 1987).

Certain types of malocclusion, such as open bite, Class II malocclusion with a large overjet and deep bite, and Class III malocclusion with posterior crossbite and lateral crossbite, may be linked to temporomandibular disorders (TMD) in the long term (Egermark, Magnusson, & Carlsson, 2003). However, the evidence of the correlation between TMD and different types of malocclusion appear to be weak, although a unilateral crossbite is suggested as factor in some patients (Egermark et al., 2003).

In addition, malocclusion may give rise to pain by causing gingival and mucosal trauma, such as in some cases of very deep overbite where the direct trauma to the palatal aspect of gingiva from the incisal edges of the mandibular incisors may result in gingival recession in the maxillary incisors (Geiger, 2001). Similarly, in severe Class II division 2 malocclusions, the retroclined

maxillary incisors contacting with the labial gingiva of lower incisors can lead to marginal recession of the mandibular incisors (Geiger, 2001).

Psychological impact of malocclusion

The dentition plays an important role in facial appearance because people are frequently concerned with dental arrangement, alignment, and appearance and malocclusion can impact on the overall facial appearance (Kerosuo, Hausen, Laine, & Shaw, 1995). The dentofacial appearance can influence social acceptance as well as the perceived intelligence by others (Langlois et al., 2000). Some studies have found that certain occlusion traits, namely incisor crowding and median diastemas, have the greatest negative impact on the perceived intelligence and beauty by others, and that those individuals were judged to be from a lower social class than those with ideal occlusion (Kerosuo et al., 1995).

Moreover, some patients with severe and deforming malocclusion reported having feelings of uselessness, shame, and inferiority in social interactions (P. Kenealy, Hackett, Frude, Lucas, & Shaw, 1991). A longitudinal Danish study which followed up 977 orthodontically untreated subjects with questionnaire survey 15 years later, concluded that certain malocclusions, especially extreme maxillary overjet, extreme deep bite, and crowding, may adversely affect body image and self-concept during adolescence as well as in adulthood (Helm, Kreiborg, & Solow, 1985b). Self-concept is defined as the perception of one's own ability to master or deal effectively with the environment, and is affected by the reactions of others towards an individual (Tung & Kiyak, 1998).

Prevalence of increased dental overjet

Among the most prevalent malocclusions is increased dental overjet as verified by The Third National Health and Nutrition Examination Survey (NHANES III) that reported that dental overjet of 5 mm or more, suggesting Angle's Class II division 1 malocclusion, occurred in 23% of children (age 8 to 11), 15% in youths (age 12 to 17), and 13% in adults (age 18 to 50) in the US population (Proffit, Fields, & Moray, 1998). Angle's class II malocclusion occurred in 32% and an overjet of 5 mm occurred in 18% of 13- 14 year old youths in Quebec, Canada (Payette & Plante, 1989). In a study conducted in Winnipeg, Manitoba to assess the preventive and interceptive orthodontic needs, 11.2% of the 6-year-old children had an overjet of more than 5 mm compared with 17.5% of the 9-year-old children (Karaiskos, Wiltshire, Odlum, Brothwell, & Hassard, 2005).

The prevalence of an overjet of more than 6 mm in 10-year-old Swedish children is about 15% (Trulsson, Linlav, Mohlin, & Strandmark, 2004). Assessment of a sample of 1975 children aged between 6 and 8 years in Germany revealed that deep overbite and overjet, both more than 3.5 mm, were found to be the most frequent discrepancies affecting 46.2 and 37.5 per cent of children, respectively (Tausche, Luck, & Harzer, 2004).

A cross-sectional study evaluated 502 urban Iranian school children aged 11-14 years found Class II division 1 in 24.1 per cent, an overjet of at least 3.5 mm or more was present in 28.1 per cent; and an overjet of more than 6 mm in 3.6 per cent (Borzabadi-Farahani, Borzabadi-Farahani, & Eslamipour, 2009).

Based on the reviewed studies, increased dental overjet is proved to be highly prevalent among adolescents, thus an appraisal of its various effects on the youths' lives would be of great interest.

Physical impacts of increased dental overjet on oral health and function

Protruding maxillary incisors have greater susceptibility to trauma and injury to the teeth. There is about one chance in three of significant trauma of prominent upper incisors, resulting in a fracture of the tooth and/or devitalization of the pulp (Tulloch, Phillips, Koch, & Proffit, 1997). Risk stakes for traumatic dental injuries (TDI) were found to be high in subjects with increased dental overjet with protrusion, economic deprivation, risk-taking behaviour, children being bullied, and attention-deficit hyperactivity disorder (Glendor, 2009).

In another study, the prevalence of TDI was reported to be 4.15% among 1059 government school children aged 4- 15 years in India (Gupta, Kumar-Jindal, Bansal, & Singla, 2011). Furthermore, incisal overjet and inadequate lip coverage were suggested as risk factors for TDI where 95.45% of the reported injuries affected maxillary anterior teeth (Gupta et al., 2011).

A systematic review aimed to gather the risk factors for TDI concluded that children with an overjet larger than 3 mm had two folds higher risk of injury to anterior teeth than children with an overjet less than 3 mm (Nguyen, Bezemer, Habets, & Prah-Andersen, 1999). Moreover, children with a TDI in the anterior teeth experienced a negative impact on social wellbeing, mainly with regard to avoiding smiling or laughing and being concerned about what other people may think or say (Bendo et al., 2010).

According Singh and coworkers (2008), a history of thumb sucking was present in 13.9% of his subjects and was significantly related to Class II div 1 malocclusion in study sample of 410 individuals aged 12 to 30 years. The Class II malocclusion was further characterized by the presence of open bite and extreme overjet when thumb sucking habit exceeded 18 months of age, as verified by the mothers of these subjects (Singh, Utreja, & Chawla, 2008).

Once established, increased overjet may result in inability to seal the lips (lip incompetence) and may increase the likelihood of an oral muscular disorder, mouth breathing, and gingival inflammation developing. Zicari and coworkers (2009) stated that malocclusion patterns that facilitate oral and nasal dysfunction; such as atypical swallowing, labial incompetence, finger sucking, and sucking of the inner lip, support the assumption that the association between oral breathing and dental malocclusions represents a self-perpetuating circle in which it is difficult to establish if the primary alteration is respiratory or maxillofacial (Zicari et al., 2009).

Harari and colleagues (2010) compared the effects of mouth breathing to nasal breathing in regards to craniofacial and dentofacial development in patients with malocclusion during childhood. They concluded that mouth breathers exhibited significant backward and downward rotation of the mandible, increased overjet, a steep mandibular plane angle, a higher palatal plane, and narrowing of both upper and lower arches at the level of the canines and first molars compared to the nasal breathers group (Harari, Redlich, Miri, Hamud, & Gross, 2010).

A study conducted in Kenya to assess gingival health of 201 schoolchildren aged 11-14 years, concluded that mouth breathing, increased lip separation, and decreased upper lip coverage at rest were all associated with higher levels of plaque and gingival inflammation (Wagaiyu & Ashley, 1991). Moreover, the study found that effect of mouth breathing was confined to palatal sites, whereas lip coverage influenced gingival inflammation at both palatal and labial sites (Wagaiyu & Ashley, 1991).

According to the reviewed literature, it is clear that protruding incisors and increased dental overjet carry potential adverse physical, developmental, and neuro-muscular consequences to children and adolescents.

Psychological impact of increased dental overjet on children and adolescents

Social discrimination and prejudgement because of facial and dental appearance were investigated in various studies. For instance, of 531 school children asked which of their physical features most provoked teasing, teeth came in the fourth place among the physical features that were objects of teasing remarks and they were indicated by 61% of children as the most upsetting (Shaw et al., 1980).

Shaw and coworkers conducted several studies on the influence of children's dentofacial appearance on their social attractiveness. One of these studies found that children with a normal dental appearance were judged to be better looking, preferred as friends, perceived to be bright, and less aggressive (Shaw, 1981). Moreover, the same study concluded that individuals who have unaesthetic protruding teeth can become targets for teasing and ridiculing from other school children and they tend to be unsure of themselves in social interaction and have low self-esteem (Shaw, 1981).

Bullying is common nowadays among school children, and the effects can be devastating and long lasting (DiBiase & Sandler, 2001). A child who is persistently bullied exhibits a certain psychological traits which include poorly developed social skills and a submissive nature (DiBiase & Sandler, 2001). Facial and dental appearances seem to play a role in the incidence of bullying among children as well as body features like height and weight, although it had been demonstrated that teasing related to dental features appears to be particularly hurtful (Shaw et al., 1980). Specific dental malocclusions, such as maxillary crowding, an increased overjet and deep overbite, have been identified that increase the risk of teasing and result in disruption of normal psychological development of the children (Helm, Kreiborg, & Solow, 1985a). Additional dental features include dentoalveolar trauma, absent teeth, and cleft lip with or without cleft palate (Hunt, Burden, Hepper, Stevenson, & Johnston, 2006).

Substantial relationships exist in literature between bullying and certain occlusal traits. A recent cross-sectional study conducted in the UK assessed 336 children aged between 10 and 14 years with an untreated malocclusion (Seehra et al., 2011). It aimed to measure the self-reported frequency and severity of bullying, the individual's self-esteem and oral health-related quality of life (OHRQoL). The study found that the prevalence of bullying was 12.8% and that being bullied was significantly associated with Class II Division 1 incisor relationship, increased overbite, and increased overjet. Moreover, bullied participants also reported lower levels of social competence, athletic competence, physical appearance related self-esteem, and general self-esteem which contributed a negative impact on overall OHRQoL (Seehra et al., 2011). Furthermore, another study demonstrated that peer teasing and negative psychosocial impact was reported by 38% of children in a sample aged between 11 to 13 years as consequence of their dental appearance that included dental crowding, incisors protrusion, and spacing (Fleming et al., 2008).

The reviewed studies strongly suggest that untreated malocclusions have negative psychological and social consequences on quality of life of children and adolescents.

Quality of life concept in orthodontics

The physical, social and psychological aspects of oral health encompass what is referred to as oral-health-related quality of life (QoL), and these provide an insight into how individual oral health status effects life quality and how oral health care and orthodontic treatment bring about improvements to QoL (Cunningham & Hunt, 2001b).

Controversy in oral esthetics and treatment need as perceived by dentists and patients

Several studies warned that a considerable disagreement exists between patients and dentists concerning aesthetics and treatment need (Mohlin & Kuroi, 2003). While visible irregularity of teeth seems to be a common and a logic motive for seeking treatment, one must be cognizant that the long term psychological benefits of orthodontic treatment are difficult to measure.

In regards to untreated malocclusion, the association between individual's concepts of body image and low self esteem persists past childhood into adulthood (Helm, Kreiborg, & Solow, 1985a). A study designed to assess children between 7 and 15 years of age who had early treatment to correct 'buck teeth' found that these patients did not exhibit low self-concept nor did their self-concept improve during the brief period of early orthodontic treatment (Dann, Phillips, Broder, & Tulloch, 1995). Thus the central role played by dentofacial appearance in developing self-concept remains controversial.

Patients and dentists differ in their evaluation of oral health and the perception of oral diseases (Hunt et al., 2002). There is only a modest correlation between patients' perception of their need for orthodontic treatment and an objective, profession-based evaluation of their malocclusion (Kok, Mageson, Harradine, & Sprod, 2004). Traditionally, measures of orthodontic need and outcome have placed little emphasis on the patient's perception of need and more importantly, the difference that orthodontic care makes to the children's and their families' daily lives (Mandall, Wright, Conboy, & O'Brien, 2001). Researchers and clinicians have recently focused more on patient-based outcome measures including change in oral health-related quality of life (OHRQoL) which may be particularly important in those interventions that are perceived as 'cosmetic' or 'elective' (Cunningham & Hunt, 2001a).

Oral health-related quality of life measures

Over the past decade, an extensive amount of studies was published in the dental literature aimed to assess the oral health-related quality of life of different populations with numerous occlusal traits by utilizing several subjective, questionnaire-based measures. There is a wide array of definitions of quality of life. The World Health Organization Quality of Life Group defined quality of life as: "An individual's perception of their position in life in the context of the culture and value system in which they live and in relation to their goals, expectations, standards, and concerns. It is a broad-ranging concept affected in a complex way by the person's physical health, psychological state, level of dependence, social relationships, and their relationships to salient features of their environment" (Study protocol for the world health organization project to develop a quality of life assessment instrument (WHOQOL).1993).

Several measures have been developed to assess oral health-related quality of life using measures relevant to children and their families, the majority of which are generic, for example: Michigan Oral Health-Related Quality of Life Scale-Child Version (Filstrup et al., 2003), Child-Oral Impacts of Daily Performance (Child-OIDP) (Gherunpong, Tsakos, & Sheiham, 2004), and Child Oral Health Quality of Life (COHQoL) Questionnaire (Jokovic et al., 2002). Only a few measures are truly condition-specific, for example the Orthognathic Quality of Life Questionnaire (Cunningham, Garratt, & Hunt, 2000). Mandall et al developed a measure for use in orthodontics and called it Oral Aesthetic Subjective Impact Scale (OASIS) (Mandall, McCord, Blinkhorn, Worthington, & O'Brien, 2000).