

Impact of orthodontic treatment on oral health-related quality of life: a critical review

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Abstract

Introduction

The purpose of this paper is to discuss critically the impact of orthodontic treatment with a fixed appliance on individuals' oral health-related quality of life. Longitudinal and cross-sectional studies were evaluated by a critical review of English-language articles retrieved from the PubMed electronic database. The selected articles were identified from titles, abstracts and full-text articles by two independent reviewers, considering the tabulated inclusion and exclusion criteria. Disagreements were resolved by consensus.

Conclusion

A total of 17 full-text articles were included in the present critical review, which showed that the results from a successful orthodontic treatment improve individuals' emotional well-being and their quality of life. However, this improvement is observed on short-term evaluations. There is no evidence that orthodontic treatment with a fixed appliance has long-term effects on oral health-related quality of life.

Introduction

Health-related quality of life is defined as an emotional assessment which one makes regarding one's health status¹. When these considerations focus on orofacial concerns, oral health-related quality of life (OHRQoL) is assessed². Instruments

which assess OHRQoL have been widely used in oral health surveys and clinical trials in dentistry. These measures document the functional and psychosocial outcomes of oral disorders and their treatment. Thus, they are intended to supplement clinical indicators to provide a comprehensive account of the health of individuals and populations³.

Oral disorders, such as caries and periodontal disease, are major public health problems in all regions of the world. Their impact on individuals and communities as a result of pain, impairment of function and reduced quality of life they cause is considerable⁴. Likewise, malocclusion can impair quality of life by affecting function, appearance, socialising and psychological well-being⁵. Conditions that affect dental aesthetics, such as anterior crowding and median diastema, have repercussions for individuals' daily life⁶.

There is also growing research interest in the relationship between orthodontic treatment and OHRQoL. Typically, assessments of pre- and post-orthodontic treatment changes are based on traditional clinical or standard measurements, such as cephalometric data and occlusal indexes. More recently, some subjective indicators have been developed and adapted as new methods for measuring treatment need and comparing results. In this case, the individual's perception is the crucial link with treatment need and satisfaction. Clinical measurement is undeniably important, but the dimensions of dental, social and functional impacts are equally relevant, especially in orthodontics, where all

treatment phases play a remarkable part in patients' lives in psychosocial terms⁷. Moreover, orthodontic treatment places a considerable burden on oral health care globally, particularly when it is funded by public resources⁸.

Since social and psychological effects are often the main reasons for seeking orthodontic care, OHRQoL can be considered the best measurement for orthodontic treatment need and outcome. Such information may be of great value to researchers, health planners, oral healthcare providers and public authorities⁹. In preparing this critical review, we sought to assess the literature related to the impact of orthodontic treatment with a fixed appliance on people's OHRQoL.

Search strategy

This critical review involved a search of the literature in the PubMed electronic database. The following search syntax was used: (quality of life [MeSH term] OR life quality [text word]) AND (orthodontic treatment [text word] OR orthodontic therapy [text word]). We limited the search to reports which were written in English, used human subjects and had been published up to the second week of September 2013.

Study selection and data extraction

The selected articles were identified from titles, abstracts and full-text articles by two independent reviewers. Disagreements were resolved by consensus. Table 1 shows the inclusion and exclusion criteria for selection of the articles.

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Table 1 Inclusion and exclusion criteria for selection of the articles

Inclusion criteria
Investigations needed to directly assess the impact of orthodontic treatment with a fixed appliance on people's OHRQoL.
Use of validated instruments for measuring OHRQoL.
English-language articles.
Exclusion criteria
Literature reviews.
Case reports.
Studies only with abstract or with no available abstract.

publications. Independent initial screening of the titles and summaries with respect to the question reviewed resulted in the consideration of 41 publications. Thus, out of the initial 817 articles, 776 were excluded after screening of the titles and abstracts. A total of 41 full-text articles were obtained and ultimately, after application of the inclusion and exclusion criteria, 17 full-text articles were included in the present critical review (Table 2).

Table 2 Selected articles assessing the impact of fixed orthodontic treatment on individuals' OHRQoL

Author	Study design	Sample size	Age	Measure
de Oliveira and Sheiham (2004)	Cross-sectional	1675	15–16	OHIP
Kenealy et al. (2007)	Longitudinal	337	11–31	Several
Zhang et al. (2007)	Longitudinal	217	11–14	CPQ
Zhang et al. (2008)	Longitudinal	217	11–14	CPQ
Agou et al. (2008)	Longitudinal	45	11–14	CPQ
Gazit-Rappaport et al. (2010)	Longitudinal	69	Adults	PIDAQ
Chen et al. (2010)	Longitudinal	250	Adolescents	OHIP
Liu et al. (2011)	Longitudinal	342	>16	OHIP
Arrow et al. (2011)	Longitudinal	448	13–30	OHIP and others
Agou et al. (2011)	Longitudinal	118	11–14	CPQ
Costa et al. (2011)	Cross-sectional	579	11–14	CPQ
Palomares et al. (2012)	Cross-sectional	200	18–30	OHIP
Navabi et al. (2012)	Cross-sectional	302	>14	OHIP
Zanatta et al. (2012)	Cross-sectional	330	14–30	OHIP
Feu et al. (2013)	Longitudinal	284	12–15	OHIP
Abreu et al. (2013)	Longitudinal	96	11–14	CPQ
Brosens et al. (2013)	Longitudinal	109	11–16	CPQ

Extraction of data from the selected articles was performed with a pre-structured instrument. The following information was gleaned: authors' name, year of publication, study

design, age or age group of the population, type of measure used, main findings and relevant issues.

The literature search resulted in the identification of 817

Discussion

The authors have referenced some of their own studies in this review. These referenced studies have been conducted in accordance with the

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Declaration of Helsinki (1964) and the protocols of these studies have been approved by the relevant ethics committees related to the institution in which they were performed. All human subjects, in these referenced studies, gave informed consent to participate in these studies.

Measures for OHRQoL

Measures which address OHRQoL are being used with increasing frequency in oral health surveys and clinical trials in dentistry. It is now generally accepted in the research community that they are essential for making clinical decisions, and evaluating dental interventions, services and programmes³.

The Child Perceptions Questionnaire (CPQ₁₁₋₁₄) is an OHRQoL instrument for children. This age-specific questionnaire (11–14 years) consists of 37 items, grouped into four subscales or domains: oral symptoms, functional limitations, emotional well-being and social well-being. Each item asks about the frequency of events, as regards to the teeth, lips and jaws, in the previous 3 months. The response options are 'never', 'once or twice', 'sometimes', 'often' and 'every day or almost every day'. Additive scale and subscale scores were calculated by summing the item response codes. Although the instrument has been designed to yield an overall score, a separate score can be generated for each subscale. Higher scores denote worse OHRQoL³. The ISF:16 is the short form of the CPQ₁₁₋₁₄. This measure derives structurally from the 16 items in the full-length version that obtained the highest scores, indicating greater impact on children's OHRQoL. The items are also distributed among four subscales¹⁰.

The Oral Health Impact Profile (OHIP) was developed in Australia and its short form was published in 1997. This instrument has 14 questions distributed across seven

domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap. Respondents are asked to rate how frequently they have experienced an oral health impact. The response to each item is scored on a five-point rating scale: the options are 'never', 'hardly ever', 'occasionally', 'fairly often' and 'very often'. A higher OHIP score indicates poorer OHRQoL¹¹.

The Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) is a specific questionnaire for assessing the psychosocial impact of dental aesthetics on young adults aged 18–30 years. It is composed of 23 items distributed across four subscales: aesthetic concern, psychosocial impact, social impact and dental self-confidence. A five-point scale is used, ranging from 0 (no impact of dental aesthetics) to 4 (maximal impact) for each item. The response options are as follows: 'not at all', 'a little', 'somewhat', 'strongly' and 'very strongly'¹².

Assessment of the impact of orthodontic treatment on adolescents' OHRQoL with the CPQ₁₁₋₁₄

Seven articles evaluated the OHRQoL of adolescents between 11 and 14 years of age during orthodontic treatment with a fixed appliance using the CPQ₁₁₋₁₄¹³⁻¹⁹. Of these seven articles, one was a cross-sectional study and six were longitudinal evaluations. The CPQ₁₁₋₁₄ was found to be sensitive to change in the context of orthodontic treatment for children with malocclusion. Responsiveness to change resulting from orthodontic interventions has been acceptable for this instrument with moderate effect sizes observed. Thus, the CPQ₁₁₋₁₄ is a useful measure for orthodontic trials and has become a popular tool in orthodontic outcome research¹⁵.

In a cross-sectional assessment of the impact of wearing a fixed appliance on Brazilian adolescents' quality

of life, the authors concluded that participants who were under orthodontic treatment had significantly worse OHRQoL compared with a control group with no treatment. Nevertheless, they also reported that further longitudinal studies were required in order to investigate the effect of fixed appliances on OHRQoL¹⁶. Longitudinal study designs are more appropriate for quantifying change in health status and provide better evidence about effects of treatment than cross-sectional studies²⁰.

Significant changes in adolescents' OHRQoL are associated with fixed appliances in the course of orthodontic therapy. When adolescents' OHRQoL was longitudinally assessed during the first year of orthodontic therapy, a significant deterioration of overall quality of life was noted when one year of treatment and pre-treatment were compared. This prospective evaluation with 109 Belgian adolescents showed a significant decrease for the objective dimensions of oral symptoms, functional limitations and social well-being¹⁹. This worsening in OHRQoL levels is more evident at the onset of treatment. In a longitudinal study with Chinese adolescents, individuals experienced more oral symptoms and worse functional limitations during the first 6 months of treatment compared with pre-treatment. The period of greatest deterioration occurred during the first week and the first month of treatment. There was, however, an improvement in adolescents' emotional well-being in the same treatment interval. This might be related to the fact that fixed appliances have become more popular and the subjects' peers were more accustomed to them so that psychological adaptation occurred more rapidly¹⁴. The impact on quality of life after insertion of appliances was clear, although it was considerably less than what adolescents expected¹³. On the other hand, when Western adolescents' OHRQoL was prospectively

evaluated during the first month of fixed orthodontic appliance therapy, there was also an improvement in individuals' emotional well-being as well as in their overall quality of life. Nevertheless, no significant changes in the oral symptoms and functional limitation domains were observed¹⁸. Individuals' OHRQoL improvement could also be observed when the longitudinal assessment of quality of life was performed before treatment and after the end of therapy. In a Canadian study, 118 individuals aged 11–14 years who were seeking orthodontic treatment were divided into two groups. The treatment group was composed of 74 adolescents who were subjected to orthodontic treatment with a fixed appliance. They answered the CPQ_{11–14} before and after therapy. The control group was composed of 44 adolescents on a waiting list. They answered the CPQ_{11–14} at the same time as the treatment group. This sample of adolescents reported significant reductions in negative oral impacts after orthodontic treatment compared with control subjects of similar age, sex and dental condition. Evaluation of the overall sample suggested that there was a trend for OHRQoL to improve over time regardless of treatment status. Of the six longitudinal evaluations, this study is the only one that used a control group. Normal biological variation, researcher bias and environmental variation are all factors that can skew data. As well as eliminating these variables, control groups help the researcher to show that the experimental design is capable of generating results¹⁷.

Assessment of the impact of orthodontic treatment on adolescents' and adults' OHRQoL with the OHIP

Eight studies assessed the impact of orthodontic treatment on individuals' OHRQoL using the short form of the OHIP^{21–28}. Of these eight articles, four were cross-sectional assessments

and four were longitudinal studies. The OHIP was developed for older adults, but it was subsequently adapted and validated for teenagers. Therefore, it is the most valid tool for evaluating OHRQoL in all age groups^{21,26}.

In a cross-sectional study which assessed whether Brazilian adolescents who had completed orthodontic treatment had lower levels of impact on their OHRQoL, 1675 individuals aged between 15 and 16 years were randomly selected from public and private schools. Three groups were identified according to their orthodontic treatment history: treated, currently under treatment and untreated. The sample size was calculated to have a 90% power of demonstrating statistically significant differences among groups. Adolescents who had completed orthodontic treatment had a better OHRQoL than those under treatment or those who never had treatment²¹. This cross-sectional evaluation was also performed in a sample of Brazilian adults. Subjects were recruited at a state-funded university clinic. The sample comprised of 100 patients in the retention phase of orthodontic treatment for more than 6 months and 100 non-treated individuals who were seeking orthodontic treatment and were still on a waiting list. Brazilian adults who had already received orthodontic treatment had significantly better OHRQoL than non-treated subjects²⁵. Similar results were obtained in a study with a sample of 302 Iranian young adults divided into two groups. The case group participants were selected from patients who had already been referred to a private orthodontic clinic and had already received orthodontic therapy. The control group participants were selected from individuals seeking treatment at the same clinic. The results of this study showed that fixed orthodontic treatment leads to an improvement in people's quality of life²⁶.

OHRQoL was also evaluated longitudinally in a sample of 250 Chinese patients under fixed orthodontic

appliance therapy. The mean age of the participants was 15.7 years. Individuals completed six distinct intervals of the OHIP. The first investigation for baseline data was finished before appliance bonding and any tooth extraction, which might have been a necessary procedure in some cases. The questionnaire was also presented to subjects for prospective evaluations at 1 week, 1 month, 3 and 6 months after appliance placement, and after treatment. It was concluded that fixed orthodontic appliance affects Chinese patients' quality of life. Participants' OHRQoL was worse during treatment compared with pre-treatment until 1 month after insertion of appliances because of the combination of physical pain, psychological discomfort and physical disability. However, OHRQoL significantly improved post-treatment²². Similar results were found in a sample of 232 Chinese adults under fixed orthodontic appliance therapy. OHRQoL was assessed at four points: before treatment, and 6, 12 and 18 months after banding and bonding. The greatest deterioration in quality of life occurred in the early phase of therapy. With on-going treatment, the detrimental effects were reduced²³. This prospective evaluation was also performed in Brazilian adolescents between 12 and 15 years of age under fixed orthodontic therapy. All subjects were interviewed with the OHIP before treatment, and 1 year and 2 years after appliance placement. Individuals experienced worse OHRQoL during treatment because of functional limitations and physical pain. Adolescents' overall quality of life improved after 2 years, however, because of the decrease of OHIP scores. The methodology of this study was strengthened by the use of two control groups to prevent behavioural influences affecting the results. Behavioural differences between adolescents who did and did not seek treatment seemed to play an important role in influencing their OHRQoL²⁸. During the treatment, patients' OHRQoL can also be negatively affected

by gingival enlargement. Although they are temporary and cause no permanent damage to periodontal supporting tissues, these alterations contribute to a worse quality of life of people under fixed orthodontic appliance therapy²⁷. A 17-year observational study reported on the longitudinal follow-up of quality of life, well-being and self-esteem outcomes of orthodontic treatment among a cohort of adults. Adolescents who were examined in 1988–1989 were invited to a follow-up in 2005–2006. A limitation of this study, however, was that information about OHRQoL was not collected at baseline, and hence changes in this factor over time could not be determined²⁴.

Psychological health gain from orthodontic treatment

Three studies evaluated the psychological health gain from orthodontic treatment^{17,29,30}. One study specifically assessed the short-term psychosocial impact of dental aesthetic improvement following orthodontic treatment. Sixty-nine adult individuals were requested to complete the PIDAQ before treatment. The duration of their therapy was between 6 and 14 months and the main goals were tooth alignment, crowding alleviation or space closure. After appliance removal, they completed an identical PIDAQ. Thus, each patient served as his/her own control. The findings of the present study supported the hypothesis that orthodontic treatment has a short-term positive impact on the psychosocial aspects of patients' life³⁰. Children with low psychological well-being might benefit from orthodontic treatment, but further work, with larger samples and longer follow-ups, would be needed to confirm this finding and to improve our understanding of how other psychological factors relate to patients' OHRQoL¹⁷.

On the other hand, a 20-year prospective longitudinal cohort study with 332 participants concluded that orthodontics cannot be justified

on psychological grounds alone, although there are minor psychological effects that contribute to an individual's perception of self-worth. Although dentition is important to the individual's perception of self from a phenomenological perspective during adolescence, by adulthood other psychological and social factors are of greater significance for the maintenance of general health and psychological well-being. Lack of orthodontic treatment where there was a prior need did not lead to psychological difficulties in later life²⁹.

Conclusion

Orthodontic treatment with a fixed appliance has an impact on individuals' quality of life. Patients' OHRQoL is worse during the first months of therapy because of the combination of oral symptoms and functional limitations. OHRQoL is significantly better post-treatment, however, thanks to improvements in emotional and social well-being.

These improvements have been observed in short-term evaluations, and no evidence supports the assumption that orthodontics significantly improves long-term psychological well-being.

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