

ORIGINAL ARTICLE

The objective and subjective outcome of orthodontic care in one municipal health center

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Abstract

Objective. The aim of this study was to assess the outcome of orthodontic care in one municipal health center. **Materials and methods.** The material consisted of one age-cohort of 15–16 year-old adolescents ($n = 67$). Of them, 97% participated in a clinical examination. The final group included in the study consisted of 61 adolescents (91% of the whole age cohort). The occlusions were evaluated applying the Occlusal Morphology and Function Index (OMFI), the Dental Health Component (DHC) and the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN). Moreover, all adolescents filled in a semi-structured questionnaire enquiring about their satisfaction with the function and appearance of their own dentition and self-perceived orthodontic treatment need. They also scored their own dental appearance on a Visual Analog Scale (VAS). **Results.** Of the adolescents, 42% had received orthodontic treatment, while 58% were untreated. All morphological criteria of the OMFI were met by 58% of orthodontically treated and 49% of untreated adolescents and all functional criteria by 67% and 57%, respectively. Treatment need was registered in two of the treated adolescents (7%) and five of the untreated adolescents (14%). Treated adolescents were more often satisfied with their dental appearance than untreated adolescents ($p = 0.034$). In both groups, satisfaction with the function was high (93%). **Conclusions.** Orthodontic treatment seems to improve both occlusal morphology and function. The high satisfaction with one's own dental appearance among the treated adolescents is worth noting.

Key Words: occlusal function, occlusal morphology, OMFI, orthodontic treatment need

Introduction

In Finland, orthodontic care constitutes one part of the public oral health services and the municipalities are required to arrange this care equally for all inhabitants [1,2]. In 2005, the Finnish Ministry of Social Affairs and Health published guidelines for the assessment of non-emergency treatment, including criteria for orthodontic treatment [3]. According to these criteria, patients for orthodontic care should be selected using an updated version of the standardized 10-grade scale [2–4], originally adapted from the Treatment Priority Index by Grainger [5].

In 2009, the population of Finland was ~ 5.3 million [6]. At that time, 147 specialist orthodontists were of working age, 80 of them employed in municipal health centers [7]. Due to limited specialist recourses, in most

health centers, orthodontic treatment was provided by general practitioners under the supervision of specialist orthodontists [2].

In Finnish health centers, all dental care, including orthodontics, is free of charge to children and adolescents up to the age of 18 years. In any publicly funded orthodontic care system it is advisable to evaluate the effectiveness of treatment at regular intervals [2,8]. It is important to assess whether the investment in orthodontics has promoted dental health in the target population and increased satisfaction with dental appearance and occlusal function [9,10]. In order to identify the real effects of the applied treatment strategy at the population level, both treated and untreated subjects must be investigated [11].

Indices designed for evaluation of orthodontic treatment need have also been applied to assess the

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outcome, including the residual treatment need among orthodontic patients [12–17]. The Occlusal Morphology and Function Index (OMFI) was developed to clinically evaluate the outcome of orthodontic care at the population level. The OMFI is based on the Finnish orthodontists' opinions on traits that determine the acceptability of dental occlusion and function (Table I) [10]. It consists of seven morphological and four functional criteria that are categorized dichotomously as acceptable (score 1) or non-acceptable (score 0). Thus, the score for acceptable morphology is 7 and that for acceptable function is 4 [18,19].

Concern for dentofacial appearance has been the patients' main reason for seeking orthodontic treatment [20]. The Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN) [21] has been used in several studies for rating dental attractiveness. The AC consists of 10 dental photographs scored from 1–10; score 1 represents the most

attractive arrangement of teeth, while score 10 represents a definite treatment need based on aesthetics. The AC has been applied to reveal both professionals' and lay persons' opinion on dental appearance [13,22,23].

The aim of this study was to assess both the objective and subjective outcome of orthodontic care in one municipal health center.

Subjects and methods

The orthodontic treatment protocol

In the health center evaluated, the orthodontic treatment need had been assessed using the 10-grade scale as recommended by the Finnish National Board of Health [4,24]. The individuals for orthodontic assessment had been pre-selected by general practitioners during routine oral examinations. All patients were selected by one orthodontically-experienced general practitioner and the applied threshold for orthodontic care was grade 7. Diagnoses and treatment plans were made by a specialist orthodontist, who also supervised the treatments provided by the experienced general practitioner.

A total of 41% of treatments ($n = 11$) were started during early mixed and 59% ($n = 16$) during late mixed or permanent dentition. Seventy per cent ($n = 19$) of the treatments were carried out with a functional appliance or some other simple appliance (such as a quad-helix, transpalatal or lingual bar), while in 30% of the cases a full fixed appliance was applied. In three of them (11%), the fixed appliance was used in both arches. The most commonly used appliances were extra oral traction ($n = 15$), eruption guidance appliance ($n = 8$), full fixed appliance ($n = 8$) and quad-helix ($n = 7$). Moreover, lingual or transpalatal bars, cross elastics and lip bumpers were used in some individual cases. The retention phase was carried out with removable plates, fixed retainers or eruption guidance appliances.

Subjects

An invitation letter was sent via the school to all pupils born in 1989 ($n = 67$). Of these, 38 boys and 27 girls (97% of the entire age cohort) agreed to participate in the study. The mean age of the participants was 15.9 years. Fifty-eight per cent of the adolescents were orthodontically untreated, while 42% had received orthodontic treatment. A total of 11% of treatments had been discontinued. At the time of the study, three adolescents (5%) were still wearing appliances. The dropout percentage was three; one girl cancelled without giving any reason and one boy did not arrive at the clinical examination despite renewal calls. Neither of these adolescents had received orthodontic treatment.

Table I. The morphological and functional criteria of the Occlusal Morphology and Function Index (OMFI).

	Cut-off for acceptability
<i>Morphological criteria</i>	
Coincidence between the facial midline and the midline of the upper dental arch	Max 3 mm deviation accepted.
Overjet	0–5 mm accepted.
Overbite	Occlusal contact incisal to the gingival third of the palatal surface of the upper incisors accepted. Open bite only accepted in lateral incisors.
Canine relationship right/left	Normal ± 2 mm accepted. Post-normal relationship accepted in the case of missing upper incisors.
Crossbite	Accepted in one tooth pair/side without interference or slide. Not accepted in incisors and canines.
Scissors bite	Not accepted.
<i>Functional criteria</i>	
Discrepancy between centric relation and intercuspal relation	Max 2 mm accepted sagittally and vertically. No slide accepted laterally.
Guided lateral excursions	Accepted: canine protection/group contact including canine/contacts in incisors, premolars and molars.
Non-working side contacts	Accepted without disclusion of working side contacts.
Protrusion contacts	Anterior guidance accepted.

Thus, the final study group consisted of 61 adolescents (91% of the whole age cohort). The orthodontically treated group comprised 24 participants (13 boys and 11 girls), including adolescents with an orthodontic treatment history; participants wearing retention plates or fixed retention wires and those with discontinued treatment. In contrast, those with active treatment were excluded from the clinical examination and thus from the study group. The group of untreated adolescents consisted of 37 participants (25 boys and 12 girls).

Methods

All participants filled in a semi-structured questionnaire asking about satisfaction with the appearance and function of their own dentition, orthodontic treatment history, symptoms of the temporomandibular joint dysfunction and their self-perceived orthodontic treatment need. Moreover, they were asked to score their own dental appearance on a Visual Analog Scale (VAS) anchored with photographs 1 (good occlusion) and 10 (definite treatment need based on aesthetics) of the AC [21].

A clinical examination was carried out by one specialist orthodontist. The occlusions were evaluated applying the OMFI [19] and treatment need was assessed using the Dental Health Component (DHC) and the AC of the IOTN [21]. In borderline cases, the occlusions were documented with clinical photographs. These cases were discussed afterwards with another specialist orthodontist until a consensus was reached.

After the clinical evaluation, data concerning orthodontic treatment history were collected from patient documents. Orthodontic treatment was regarded to have been started when any procedure to enhance the development of the occlusion was made.

Statistical methods

The differences between orthodontically treated and untreated adolescents and between genders were tested with the chi-square test and, in case of low frequencies, with the Fisher's exact test. *p*-values less than 0.05 were interpreted as statistically significant. Statistical computing of the data was performed with the SAS® System for Windows, release 9.1.3 (SAS Enterprise Guide 4.1).

Results

Morphology

All the morphological criteria of the OMFI were met by 58% of orthodontically treated and by 49% of untreated adolescents ($p = 0.002$) (Figure 1). Among

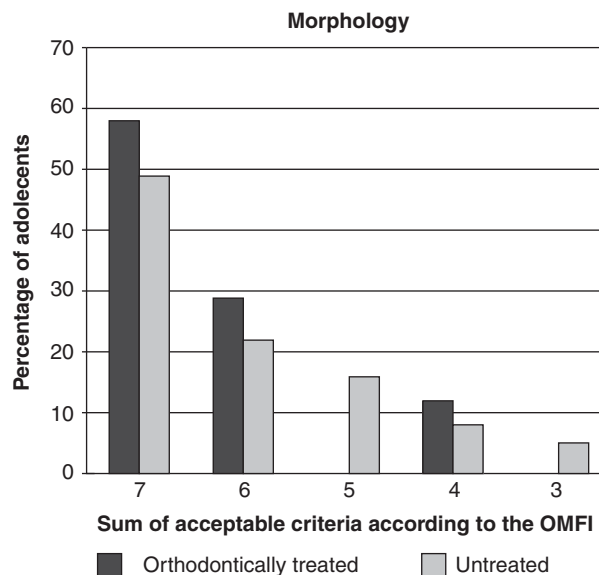


Figure 1. Distribution of the sums of acceptable morphological criteria among the orthodontically treated and untreated adolescents according to the Occlusal Morphology and Function Index (OMFI). Value 7 represents a morphologically acceptable occlusion.

the untreated adolescents, boys had a better morphology than girls ($p = 0.004$), while there were no statistically significant differences between genders among treated adolescents. In the entire age cohort, the main defect in morphology was deviation in the canine relationship (treated: 17% right side, 25% left side; untreated: 24% and 27%, respectively).

Function

All the functional criteria were met by 67% of orthodontically treated and by 57% of untreated adolescents ($p = 0.007$) (Figure 2). No differences were found between genders. The most common functional reason for an occlusion to be categorized as non-acceptable was lack of anterior guidance in protrusion movement (17% treated, 27% untreated).

Treatment need

Residual treatment need was registered in two of the treated adolescents (7%); this need was based on a lingually impacted lower canine (DHC 4t) and an increased overjet greater than 9 mm (DHC 5a). Both of these adolescents had discontinued treatment. In the untreated group, treatment need was registered in five cases (14%); in three of these, this need had not been diagnosed before. The recorded occlusal deviations were as follows: an overjet greater than 6 mm but not exceeding 9 mm (DHC 4a), an anterior crossbite in one tooth pair (DHC 4c) and submerged deciduous teeth (DHC 5i). In two cases, the start of orthodontic treatment was being deliberately delayed

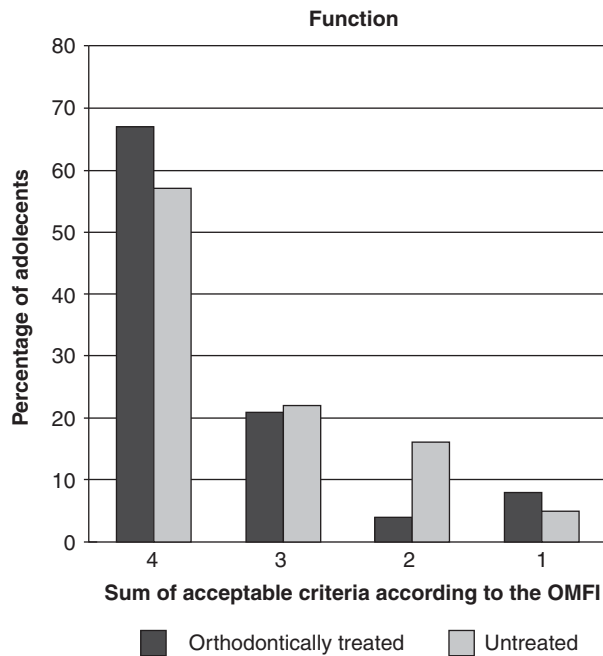


Figure 2. Distribution of the sums of acceptable functional criteria among the orthodontically treated and untreated adolescents according to the Occlusal Morphology and Function Index (OMFI). Value 4 represents a functionally acceptable occlusion.

until the adolescents' growth had ceased (DHC 4h and 4d) (Figure 3).

Aesthetically-based treatment need, assessed with the AC, was registered in two cases (3% of participating adolescents); in both, the need for treatment was also recognized with the DHC (Table II).

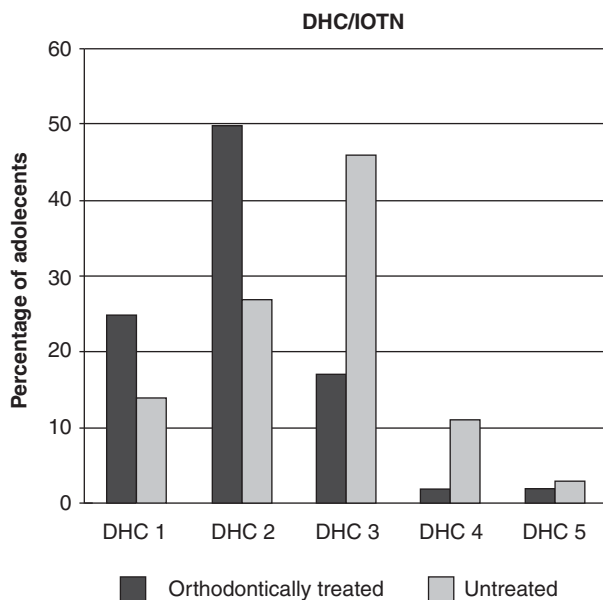


Figure 3. Distribution of the orthodontically treated and untreated adolescents into treatment need categories as assessed with the Dental Health Component (DHC) of the Index of Orthodontic Treatment Need (IOTN).

Table II. Distribution of the orthodontically treated and untreated adolescents into different treatment need categories as assessed by a specialist orthodontist using the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN).

	AC/IOTN		
	AC 1-4	AC 5-7	AC 8-10
treated adolescents ($n = 24$)	21	2	1
untreated adolescents ($n = 37$)	28	7	1

AC 1-4 no treatment need; AC 5-7 moderate need and AC 8-10 definite treatment need.

Satisfaction with dental appearance and function

According to the questionnaire, orthodontically treated adolescents were more often satisfied with their own dental appearance than the untreated adolescents (88% vs 83%) ($p = 0.034$). They also scored their dental appearance significantly higher in the VAS-scale than the untreated adolescents. Among the treated adolescents, the range on the VAS-scale was 1-4, as opposed to the 1-8 of the untreated adolescents ($p = 0.002$).

A high percentage (93%) of all the adolescents evaluated was satisfied with their occlusal function. Only one participant reported bruxism and two others occasional headache. Only girls reported problems related to occlusal function.

Self-perceived treatment need

Self-perceived orthodontic treatment need was reported equally by both groups, by 4% of the treated and 5% of the untreated adolescents. The reasons for the dissatisfaction with their dental appearance for all these adolescents were malpositioned or crowded anterior teeth or diastemata.

Discussion

In this study, we analyzed the outcome of orthodontic care in one municipal health center. According to the custom in many Finnish health centers, orthodontic treatment had been provided by one general practitioner under the supervision of a specialist orthodontist. According to the criteria in the OMFI, acceptability of morphological and functional traits was fulfilled more often among the orthodontically treated than untreated adolescents. The percentages in this study are in line with previous results reporting acceptable morphology in 40-72% and acceptable function in 35-68% of orthodontically treated subjects [19,25].

The adolescents with orthodontic treatment history reported satisfaction with their own dental appearance more often than untreated subjects, which contradicts

earlier findings that untreated subjects are more often satisfied [20,22,26]. In line with other studies, the majority of all participating adolescents were satisfied with their function of occlusion [4,13,27].

In three adolescents, orthodontic treatment need (DHC grades 4 and 5) was revealed for the first time in this study, at the age of 15–16 years. It is likely that the severity of these malocclusions had increased during ongoing occlusal development. Thus, orthodontic check-ups are required until the end of occlusal development. It should also be born in mind that the first signs of a developing malocclusion are not always easy to discover, even if the observer is an experienced orthodontist [28]. Therefore, both general practitioners and specialist orthodontists ought to be trained and calibrated in using the applied criteria for selection of orthodontic patients. Furthermore, principles for screening should be updated regularly by discussions and training [29].

The age cohort of 15–16-year-olds was selected for this analysis because at this stage most orthodontic treatments were expected to be completed. Due to the age group still being in secondary school, the number of dropouts was low. Although the final number of adolescents included in the study was small ($n = 61$), it represented 91% of the whole age cohort living in the municipality. The proportion of orthodontically treated adolescents was slightly lower than in other Finnish studies in which the proportions of orthodontically treated young adults have varied between 42–52% [13,16,19,20]. The share of discontinued treatments corresponded well to the earlier findings [13,16,20,21]. However, the small number of orthodontically treated adolescents and the heterogeneity of appliances used did not allow for comparisons between different treatment methods or the timing of treatment.

Finnish orthodontists and general practitioners pay great attention to the functional aspects of the occlusion [10]. Several indices have been developed for evaluation of treatment outcome [30,31], but only the OMFI includes separate criteria for the assessment of occlusal function. Because the OMFI was developed according to Finnish orthodontists' opinion on acceptable morphology and function, it was found to be well-suited for the purposes of this study. The index is based entirely on direct clinical assessment, which makes it applicable to studies conducted on a population basis. Moreover, the reproducibility of all included numerical and categorical evaluations has been found to be good [18]. In order to compare our results to those of earlier studies, we completed the clinical evaluation with the DHC of the IOTN [13,18,20,32]. In our results, the treatment need percentage was markedly lower. Thus, as only a few DHC codes were detected, it was not possible to make any comprehensive comparison.

Conclusions

The main findings of this population-based study suggest that:

- (1) orthodontic treatment provided by general practitioners and supervised by specialist orthodontists seems to improve both occlusal morphology and function, and
- (2) the high satisfaction with one's own dental appearance among the orthodontically treated adolescents is worth noting.

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