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Relationship between occlusion and satisfaction with dental appearance in orthodontically treated and untreated groups. A longitudinal study

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SUMMARY The aims of this study were to assess the relationship between occlusion, satisfaction with dental appearance, and self-esteem at the ages of 11 (T_1) and 15 years (T_2), and to study perceived treatment effects. Separate questionnaires were completed by children and their parents to determine their attitude. The dental casts of 224 children were collected at T_1 and T_2, and assessed by the Aesthetic Component (AC) and Dental Health Component (DHC) of the Index of Orthodontic Treatment Need (IOTN), and Peer Assessment Rating (PAR) Index.

At T_2, 16 children had been treated with removable and 51 with fixed appliances, while 157 were untreated. The children in the fixed appliance group had better dental aesthetics (AC) and occlusion (DHC) than those in the two other groups. Average PAR score reduction was 71.6 per cent (T_1–T_2) and satisfaction with own or child's dental appearance increased significantly. The untreated group showed increased malocclusions. In spite of that, the children expressed higher satisfaction with their own dental appearance at T_2 than at T_1, while the parents' satisfaction level was unchanged. For the total group, orthodontic concern at T_1, AC at T_2, and gender accounted for 18.0 per cent of the variation in the children's satisfaction with their own dental appearance. Parents' concern at T_1 and AC at T_2 accounted for 32.2 per cent of the variation in parents' satisfaction. Improvement in self-esteem from 11 to 15 years was not correlated with treatment changes. A gender difference was found. The answers to the questionnaire indicated that both children and parents rate pleasant aesthetics as an important factor for psychosocial well being.

Introduction

An important motivation factor for orthodontic treatment is improved dentofacial appearance (Gosney, 1986; Birkeland *et al*., 1999). The relationship between physical appearance and perception of an aesthetic deviation, and the impact of such a deviation on self-esteem and body image are important issues in determining the benefits from orthodontic treatment. Attention should be given to the specific occlusal and aesthetic deviations that cause concern to the patients, and assumptions based purely on the general occlusal condition should be avoided (Gosney, 1986). A variety of social, cultural, and psychological factors, and personal norms influence perception of physical attractiveness (Jenny, 1975; Baldwin, 1980). Studies in social psychology indicate that physical attractiveness plays a major role in social interaction and influence the impression of an individual's social skill (Baldwin, 1980; Shaw, 1981).

As orthodontic treatment improves facial appearance, it is assumed to increase self-worth. However, this hypothesis has been difficult to verify. One study on self-concept changes during orthodontic treatment showed no long-lasting effect on self-esteem (Korabik, 1994). Another indicated that a high self-esteem could be related to orthodontic concern (Birkeland *et al*., 1996).

An investigation of the level of self-worth and dental appearance in children could provide a clearer picture of subjective need for treatment, as well as treatment effects on self-worth. The aims of this study were: to measure aesthetic and occlusal changes from 11 to 15 years of age using the Index of Orthodontic Treatment Need (IOTN) and Peer Assessment Rating (PAR) Index to compare treated and untreated groups using the same indices; to evaluate the degree of satisfaction among treated and untreated children and their parents; to follow the children's psychological profile from 11 to 15 years of age to reveal additional indicators for satisfaction of dental appearance; and to study psychosocial treatment effects expressed by children and their parents.

Subjects and methods

Subjects at T_1 (11-year-olds)

In 1993, a sample of grade four children was established from eight schools in Bergen, Norway. In this study, Bergen was divided into four demographic areas to ensure socio-economic spread. Two schools from each area were randomly selected, and a sample of 480 children and their parents were invited to participate. A consent form for participation in the study, together with a questionnaire, was sent to the parents (Table 1a). The children filled in the questionnaires at school and were then examined at a public dental clinic. Of the 400 children (83.3 per cent) that responded, 41 (10.3 per cent) had already started or decided about orthodontic treatment, and were excluded from the investigation. Thus, the prevalence of malocclusion was recorded in 359 children (Birkeland *et al*., 1996).

Subjects at T_2 (15-year-olds)

In 1996–97 the same group of 359 children, now 15 years of age, and their parents were invited to attend a follow-up study. Separate child and parent questionnaires were used, and Table 1b presents the items analysed in this report. The parental form was sent home. The children filled in the questionnaires the same day they were examined at a public dental clinic. A positive questionnaire response was achieved from 293 (81.6 per cent) family units (children and/or parents). For the clinical examination, 42 children (11.7 per cent) dropped out for unknown reasons, 17 (4.7 per cent) had moved, and 2 (0.6 per cent) declined to re-attend. Excluding the 74 (20.6 per cent) children that were under treatment, the study sample consisted of 224 individuals (62.4 per cent). Impressions for dental study casts were taken.

Table 1 (a) Questionnaire at 11 years (T_1).

Children's form
Orthodontic concern*
1. I am satisfied with the way my teeth come together.
2. I want to have my teeth straightened.
Global negative Self-Evaluation Scale (GSE)†
At times I think I am no good at all.
I feel I do not have much to be proud of.
I certainly feel useless at times.
All in all, I am inclined to feel that I am a failure.
I would like to change many things about myself.
I have often wanted to become someone else.
Parents' form
Orthodontic concern*
1. I am satisfied with the way my child's teeth come together.
2. I want to have my child's teeth straightened.

*Response options: agree very much/agree a little/disagree a little/disagree very much (question 1: score 1–4; question 2: score 4–1).
†Response options: does not apply at all/does not apply well/applies somewhat/applies fairly well/applies well/applies exactly (score 1–6).

Table 1 (b) Questionnaire at 15-years (T_2) .

Children's form
Questions to all children
Satisfaction
1. How satisfied are you with the arrangement of your teeth?
   Very satisfied/satisfied/dissatisfied/very dissatisfied (score 1–4)

Treatment/no treatment
2. If you have consulted a specialist in orthodontics, what was the result?
   I have not received treatment and do not want it/I have not received treatment but do want it/I am going to have treatment/I am having treatment/I have had treatment (score 0–4)

GSE (see Table 1a)
Questions to children who have had or were having orthodontic treatment
Psychosocial benefit of treatment
3. Think of the situation before the orthodontic treatment started. If you were in the same position (age and dental appearance) today, and with the experience you now have obtained from the orthodontic treatment, would you have chosen to go through the same treatment?
   Yes, absolutely/yes, I think so/uncertain/no, I don't think so/no, absolutely not (score 0–4)
4. Has the treatment result had a positive influence on your self-confidence?
   Yes, absolutely/yes, I think so/uncertain/no, I don't think so/no, absolutely not (score 0–4)
5. Do you think well aligned teeth is of significance for your future?
   Yes, absolutely/yes, I think so/uncertain/no, I don't think so/no, absolutely not (score 0–4)
   (Question 5 is a combination of question 5 and 6 in the parent's form)

Orthodontic treatment results
7. How satisfied are you with the orthodontic treatment result?
   Very much satisfied/much satisfied/satisfied/dissatisfied/very dissatisfied (score 0–4)
8. If you are more or less dissatisfied with the treatment result, why is it so?
   (a) The arrangement of my teeth did not become as expected Yes/no
   (b) There have been changes in the arrangement of my teeth after treatment Yes/no
   (c) The arrangement of my teeth was as good before treatment. Yes/no
   (d) I did not use the appliance as prescribed. Yes/no
   (e) Other reasons Yes/no

Parents' form
Questions to all parents
1. I am satisfied with the way my child's teeth come together.
   Agree very much/agree a little/disagree a little/disagree very much (score 1–4)

Treatment/no treatment
2. If you have consulted a specialist in orthodontics, what has been the result for your child?
   No treatment/plan to start treatment/is under treatment/have had treatment (score 0–3)

Questions to parents whose child has had or was receiving orthodontic treatment
Psychosocial benefit of treatment for own child
3. Think back to the situation before orthodontic treatment. If you were in the same situation today, with your experience from orthodontic treatment, would you have chosen to let your daughter/son go through the same treatment?
   Yes, absolutely/yes, I think so/uncertain/no, I don't think so/no, absolutely not (score 0–4)
4. Is the treatment result of positive importance for your child's social skills?
   Yes, absolutely/yes, I think so/uncertain/no, I don't think so/no, absolutely not (score 0–4)
5. Is it likely that the treatment result will have a positive influence for future choice of mate?
   Yes, absolutely/yes, I think so/uncertain/no, I don't think so/no, absolutely not (score 0–4)
6. Is it likely that the result of orthodontic treatment will be of significance for your child's future working career?
   Yes, absolutely/yes, I think so/uncertain/no, I don't think so/no, absolutely not (score 0–4)

Orthodontic treatment results
(Similar questions as in children's form)

Model assessments

At T_1, the 359 dental casts were assessed by one examiner using the Dental Health Component (DHC) and Aesthetic Component (AC) grades of the IOTN (Brook and Shaw, 1989). The results have been reported (Birkeland *et al*., 1996).

In 1997 (T_2), the collected 224 dental casts were assessed by two calibrated examiners using the IOTN. Thirty model sets were randomly

selected and rated by both examiners as validation exercises. Additionally, the PAR Index (Richmond *et al*., 1992) was applied to the two sets of dental casts for each patient, at 11 (T_1) and 15 years (T_2) by one examiner.

Attitudes to dental appearance and wish for treatment

Both in 1993 and 1997 the questionnaires included questions about the satisfaction with own/own child's dental appearance and desire for orthodontic treatment (Table 1a,b). A composite measure of orthodontic concern at T_1 was made by adding scores of satisfaction and desire for treatment for the children and parents separately (Table 1a). The orthodontic concern variable ranged from score 2 to 8, where 8 indicated maximum concern (Birkeland *et al*., 1996).

Self-esteem

To measure the child's self-esteem, the Global Negative Self-Evaluation Scale (GSE) was used (Alsaker and Olweus, 1986, 1993) both at 11 (T_1) and 15 years of age (T_2). The children's mean scores for all six items were calculated and assigned to categories 1–4: very few negative self-evaluations (score 1–1.69), few negative self-evaluations (score 1.7–2.69), some negative self-evaluations (score 2.7–3.99), and many negative self-evaluations (4.0–6.0).

Satisfaction with treatment result

Satisfaction with treatment result was evaluated on the basis of question 7 with five reply options (Table 1b). Subjects that were dissatisfied with the result were asked to agree with or reject any of the four alternative reasons for dissatisfaction, and the last alternative 'other' was open for comments.

Perceived psychosocial benefit

A composite measure for psychosocial benefit was made by adding the individual scores of questions adapted from Jacobsen (1984; Table 1b). For the child's assessment, three questions were used (Table 1b, questions 3,4 and 5) ranging from score 0 for a strongly positive to score 12 for a strongly negative statement, while for parents' assessments four questions (Table 1b, questions 3, 4, 5, and 6) were used, with a score range from 0 to 16.

Statistical procedures

The intra- and inter-examiner assessment of DHC and AC were analysed with Kappa statistics (Landis and Koch, 1977). Cronbach's alpha was used to measure reliability of the answers to questions about satisfaction with dental appearance, psychosocial benefit, and self-esteem (Cronbach, 1951). For the PAR Index measurements, intra-examiner reliability was evaluated by the intra-class correlation coefficient and summary statistics. A chi-square test was applied to test distribution differences between sexes. A repeated ANOVA was used to test the relationship of AC, DHC, PAR, children's and parents' satisfaction and self-esteem for the 11- and 15-year-olds in the treated and untreated groups. If statistical significance was achieved, Scheffé's comparison test was used to investigate differences between pairs of groups at each time level. In addition, the paired *t*-test was used to check for significant differences between the two time levels in each group. The level of significance was reduced according to Bonferroni's adjustment, based on the number of comparisons. Pearson's correlation coefficient and a chi-square test were used to analyse associations between index scores and subjects' opinions of different items. The variables satisfaction with dental appearance and psychosocial benefit were analysed by stepwise multiple regression procedures with derivatives of the PAR and IOTN indices as possible predictors, together with patient and treatment characteristics.

The statistical analyses were performed by SPSS for Windows (Norusis, 1992).

Results

At T_1, the analyses of consistency in the answers about orthodontic concern resulted in an alpha coefficient of 0.64 for children and 0.73 for parents, and for the children's answers to GSE,

the alpha coefficient was 0.78. Intra-examiner agreement on DHC was 0.87 and on AC 0.78, expressed by the Kappa statistics. All values indicated reliability within acceptable limits (Cronbach, 1951; Landis and Koch, 1977).

At T_2, the children's answers to GSE indicated acceptable reliability with an alpha coefficient of 0.88. Reliability analysis for answers to questions about psychosocial benefit resulted in an alpha coefficient of 0.58 for children and 0.76 for parents. Inter-examiner agreement expressed by the Kappa statistic were 0.88 and 0.71 for DHC and AC, respectively. Analysis of reliability on PAR scores resulted in an intra-class correlation coefficient of 0.97.

Longitudinal comparisons between treated and untreated groups using IOTN and PAR indices

Of the 224 clinically examined children (120 girls, 104 boys), 16 (three girls, 13 boys) had been treated with removable and 51 (30 girls, 21 boys) with fixed appliances. The others, 157 (87 girls, 70 boys), were untreated (Table 2). Significantly more girls (30) than boys (21) had been treated with fixed appliances ($P < 0.05$). However, when combining treatment with fixed and removable appliances there was no sex difference. Repeated measure ANOVA showed overall change in AC, DHC, and PAR scores. For the group treated with removable appliances there was an improvement of the mean scores for AC and PAR, but significant improvement only for DHC (Table 2). The fixed appliance group showed the greatest improvements both for AC and DHC grades. In this group the PAR score was reduced from 20.6 to 5.8 (71.6 per cent). Using categorizing criteria defined by Richmond *et al*. (1992b), 17.6 per cent of the patients in this group were greatly improved, 80.4 per cent improved and 2.0 per cent became worse/no different. For the removable appliance group 43.8 per cent were categorized improved and 56.2 per cent worse/no different. No sex difference was found in indices scores for any of the treatment groups at T_1 or T_2.

For the untreated group, a significant increase in mean AC and DHC grades as well as PAR score was found from T_1 to T_2. The clinical AC assessment by the dentists showed a slight increase in AC over the 4-year period, however

Table 2 Analysis of Aesthetic Component (AC), Dental Health Component (DHC), and Peer Assessment Rating (PAR) Index score at 11 (T_1) and 15 years (T_2) for the untreated (U) and the two treated groups. TreatRA = R = group treated with removable appliances or headgear only, TreatFIX = F = group treated with fixed appliance in one or both jaws. Example: at T_1, the mean AC score by the model evaluation for TreatFix group is 4.7, «***U » indicates difference from untreated group at 0.1 per cent significance level, «*R» indicates difference from TreatRA group at 5 per cent significance level.

		n	Mean at T_1	Mean at T_2	Mean difference T_1–T_2	SD	*P*
AC by model evaluation	TreatRA	16	3.4	3.1	0.3	1.7	0.55
	TreatFIX	51	4.7***U, *R	2.0***U,*R	2.7***U,R	2.4	0.000
	Untreated	157	2.8	3.0	–0.2	1.5	0.04
AC by clinical examination	TreatRA	16	3.3	2.8	0.5**U	1.3	0.11
	TreatFIX	51	4.5***U,*R	1.8**U	2.7***U	2.4	0.000
	Untreated	157	2.5	2.6	–0.1	1.6	0.61
AC by children's own evaluation	TreatRA	16	2.6	2.2	0.4**U	1.3	0.25
	TreatFIX	51	4.1**U, *R	1.9	2.2***U	2.7	0.000
	Untreated	157	3.0	2.2	0.8	2.1	0.000
DHC	TreatRA	16	2.7	2.3	0.4*U	0.8	0.05
	TreatFIX	51	3.4***U,*R	2.0**U	1.4***U,**R	1.0	0.000
	Untreated	157	2.2	2.5	–0.3	0.9	0.002
PAR score	TreatRA	16	14.6**U	13.3	1.3	7.5	0.50
	TreatFIX	51	20.6***U,**R	5.8**U,R	14.8***U, R	7.7	0.000
	Untreated	157	8.8	10.4	–1.6	5.1	0.000

* $P < 0.05$ ** $P < 0.01$ *** $P < 0.001$.

Table 3 Analysis of satisfaction with own dental appearance, self-esteem (GSE), and parent satisfaction with own child's dental appearance for 11 (T_1) and 15 years (T_2) for the untreated (U) and the two treated groups. TreatedRA = R = group treated with removable appliances or headgear only TreatedFIX = F = group treated with fixed appliance in one or both jaws.

		n	Mean at T_1	*n*	Mean at T_2	*n*	Mean difference T_1–T_2	SD	*P*
Satisfaction with own dental appearance	TreatedRA	15	1.9	16	1.6	15	0.3	0.8	0.14
	TreatFIX	49	2.3**U	51	1.3	49	1.0***U,R	1.1	0.000
	Untreated	146	1.7	156	1.5	145	0.2	1.0	0.02
Self-esteem (GSE)	TreatRA	15	1.7**U,*F	16	1.8	15	–0.1	0.8	0.75
	TreatFIX	49	2.4	51	2.0	49	0.4	1.1	0.009
	Untreated	144	2.5	153	2.2	141	0.3	1.1	0.002
Parents' satisfaction with own child's dental appearance	TreatedRA	14	3.0	14	2.1**F,U	12	0.9	1.8	0.10
	TreatedFIX	46	2.9	39	1.3	37	1.6***U	1.2	0.000
	Untreated	140	1.6***F, R	121	1.5	110	0.1	0.9	0.16

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

this change was not significant. The children assessed their own dental aesthetics to be better at T_2 than at T_1. At T_2, both AC and PAR indicated better aesthetics and occlusal conditions in girls than in boys.

Attitudes to dental appearance

Treatment with fixed appliances had the greatest influence on the satisfaction level (Table 3). Repeated measure ANOVA showed a significant overall change in children's and parents' satisfaction with own/own child's dental appearance ($P < 0.001$). An interaction effect was found between the groups for the satisfaction variables ($P < 0.001$). At T_1, children in the fixed appliance group were more dissatisfied with their occlusion than those in the two other groups, and the parents in both treatment groups were significantly more dissatisfied than parents in the untreated group (Table 3). At T_2, the parents of children treated with removable appliances were less satisfied with their child's dental appearance compared with the two other groups. At T_1, no sex difference was discovered. At T_2, boys showed better satisfaction with their own dental appearance than girls in the untreated and removable appliance groups. However, in these two groups, the parents were less satisfied with the dental appearance in boys than in girls.

The result of stepwise regression analysis showed that children's orthodontic concern at T_1, gender, and AC at T_2 accounted for only 18 per cent of the variability in satisfaction with own dental appearance at T_2 ($R^2 = 0.18$). Approximately 32 per cent of the variability in parents' satisfaction with own child's dental appearance was explained by the parents' orthodontic concern at T_1 and AC at T_2 ($R^2 = 0.322$).

Self-esteem

Repeated measure ANOVA revealed an overall improvement in GSE score over the 4-year period ($P < 0.001$), i.e. the children achieved higher self-esteem from 11 to 15 years. No interaction effect between the three groups was found. However, there existed an interaction effect by sex ($P < 0.001$).

Satisfaction with treatment results

A high degree of satisfaction with orthodontic treatment results was recorded among both children (95.4 per cent) and their parents (95.6 per cent).

Perceived benefits

Eighty per cent of the children and most parents (92.5 per cent) would, under similar conditions,

Table 4 Percentage distribution of children's response to the questions concerning psychosocial benefits of orthodontic treatment (n = 65).

	Question 3 Would you choose to go through the same treatment again?	Question 4 Do you think that well aligned teeth are important for your future?	Question 5 Has the treatment result had a positive influence on your self-confidence?	
Yes, sure about it	80.0	44.6	Very great to moderate	50.8
Uncertain	10.8	38.5	Little	41.5
No, I don't think so	9.2	16.9	No	7.7

Table 5 Percentage distribution of parents' response to the questions about psychosocial benefits of orthodontic treatment (n = 53).

	Question 3 Would you choose to let your child go through the same treatment again?	Question 4 Is the treatment result of positive importance to your child's social skill?	Question 5 Is it likely that the treatment result will have a positive influence on future choice of mate?	Question 6 Is it likely that the result of orthodontic treatment will be of significance for your child's future working career?
Yes, sure about it	92.4	34.0	22.6	18.9
Uncertain	3.8	15.1	26.4	32.1
No, I do not think so	3.8	50.9	51.0	49.0

undergo or allow their child to go through treatment again (Tables 4 and 5). Approximately 45 per cent of the children were of the opinion that orthodontic treatment would have a positive influence on their future possibilities in life, and about half of the children felt that treatment results were important for their self-confidence. Approximately 20 per cent (R^2 = 0.203) of the variability of children's opinion of psychosocial benefits could be explained by PAR score at T_2. However, no significant increase in R^2 could be found by including changes of either IOTN or PAR scores.

One in three parents (34.0 per cent) felt that orthodontic treatment had positively influenced their child's social skill, and about 1 in 5 considered that treatment would positively influence their child's future career possibilities (18.9 per cent) and choice of mate (22.6 per cent). The variability in parents' perceived benefits was almost unpredictable, the best predictor, DHC change (T_1–T_2), explained only 8.6 per cent (R^2 = 0.086).

Discussion

Response

As the design of the study was longitudinal, a drop-out rate from the clinical examination of 17 per cent over a 4-year period had to be accepted. Some subjects who responded to the questionnaire at T_1 did not respond at T_2 and *vice versa*, thus additional persons were lost for the longitudinal comparisons. Comparisons between the drop-outs and those who remained in the study revealed no differences in AC, DHC, satisfaction with own child's dental appearance, self-esteem, orthodontic concern or gender at T_1. Consequently, the non-attendants did not appear to bias the results.

Longitudinal comparisons between the treated and untreated groups' IOTN and PAR indices

Based on the children's answers, simple treatment with removable appliances was used in 23.8 per

cent of the cases, while 76.2 per cent had fixed appliance treatment. The group treated with fixed appliances showed improved aesthetics (AC) and occlusion (DHC) compared with the two other groups of 15-year-olds, which confirms earlier findings of high treatment success with fixed appliances (Richmond and Andrews, 1993; Richmond *et al*., 1993). The finding that children were less critical in their aesthetic evaluation compared with that noted by the examiners corresponds with a previous report (Burden and Pine, 1995). The model evaluation scored lower for aesthetics than the clinical examination. This is natural as details of tooth position are more accurately evaluated on models than by clinical examination.

The pre-treatment PAR score of 20.6 in this study compared with a value of 28.7 in a pre-treatment fixed appliance treatment group at a university clinic (Birkeland *et al*., 1997) indicates treatment of more moderate malocclusions. Comprehensive treatment reduced the malocclusion on average by 71.8 per cent in this study compared with 76.7 per cent in the former investigation. The lower treatment success can be explained by the lower pre-treatment PAR score. However, comparing the post-treatment mean PAR scores of 5.8 in this study with 6.0 in the former shows a high standard of treatment results, as was also the general impression of the clinical investigation.

In the removable appliance group there was a predominance of boys and the malocclusion reduction was rather small. Only half of this group was assessed as improved according to the PAR score. One explanation may be that in some patients where the removable appliance was meant to be an introduction to later fixed appliance treatment, some patients refused to wear the fixed appliance. Most treatment was aimed at correction of a single tooth in anterior crossbite, lateral crossbites, or lateral space deficiencies, but no registration was made as to when the treatment was performed during the 4-year observation period. The changes (i.e. increased crowding) that developed in this group after the end of treatment may also have influenced the score values (Foster *et al*., 1970; Hill, 1992; Birkeland *et al*., 1997).

Attitude to dental appearance

Orthodontic treatment significantly increased satisfaction with the children's own dental appearance, and resulted in the same satisfaction level as in the untreated group. This finding is important and emphasizes the value of a longitudinal study compared with a cross-sectional design as changes in both groups can be related to the starting point. The children's satisfaction with dental appearance increased from 70.3 to 100 per cent in the treated, and from 92.5 to 97 per cent in the untreated groups. These are higher satisfaction levels than reported for 18-year-olds (Espeland *et al*., 1993) and reflect treatment to an optimal goal on a group basis. It is probably unrealistic to expect that such a high satisfaction level is permanent as some treatment relapse and other changes over time are likely (Birkeland *et al*., 1997). This may explain some of the difference compared with the 18-year-old group.

Self-esteem

More positive self-esteem was evident for the 15-year-olds compared with the younger children. The two treated groups together (GSE score 1.9) presented a higher self-esteem than the untreated (GSE score 2.2) group at T_2 ($P < 0.05$), but a similar tendency ($P = 0.08$) already existed at T_1. This indicates that the child's psychological profile can influence treatment demand, as those with high self-esteem are more likely to seek improvement. In this study the reasons for improved self-image are probably the result of age-related conditions (Alsaker and Olweus, 1993), rather than orthodontic treatment effects. The pattern of no change in self-esteem corroborates with the finding in another study (Korabik, 1994), but orthodontic treatment may enhance body image, and particularly facial image (Varela and Garcia-Camba, 1995). The sex difference became more evident from 11 to 15 years of age, as more girls than boys had developed negative self-evaluation. This agrees well with an earlier study (Alsaker and Olweus, 1993).

Satisfaction with treatment result

The high degree of satisfaction with treatment results are close to the quality values proposed by Bergström (1996). Only three children were dissatisfied with the treatment result. One girl had agenesis of the upper laterals and the canines were mesialized to contact with the centrals. The result was professionally good, but both child and parents were dissatisfied. A second girl with small rotations of the upper laterals was dissatisfied, whereas her parents were satisfied with the result. A third girl with an overjet and open bite refused fixed appliances after treatment with a tongue crib plate. Both the parents and child were dissatisfied with the treatment result.

Perceived benefits

For patients, treatment effects can be reflected in higher satisfaction with their own dental appearance compared with the pre-treatment situation. The significance of aesthetic achievement for perceived benefits corresponds with other results and is the most frequent reason for treatment (Baldwin 1980; Albino *et al*., 1994; Birkeland *et al*., 1997, 1999).

However in this study, the PAR Index was slightly better than AC as a predictor of variability in children's perceived psychosocial benefits. In an earlier retrospective study AC was more important (Birkeland *et al*., 1997). The explanation for this may be that the children have developed a higher awareness of dental irregularities during treatment and that the PAR Index reflects small irregularities better than the AC. The explanatory level of 20 per cent for the variability of psychosocial benefits corresponds with that of 22 per cent from a retrospective study (Birkeland *et al*., 1997). From the children's perspective the most positive influence of orthodontic treatment was increased self-confidence, especially among girls. Approximately 45 per cent felt that the result of orthodontic treatment would positively influence their future. Orthodontic treatment was considered important even in those where teeth irregularities were small, which may reflect the great importance that young people today attach to straight teeth (Bergstöm *et al*., 1998).

The parents' perceived psychosocial benefit was almost unpredictable by pre-treatment index scores, which is somewhat surprising. The change in DHC from T_1 to T_2 was the only significant predictor, but at the low level of 8.6 per cent. The parents assessed the greatest treatment benefits on social skill and prospective choice of mate, and lowest for future working career. This corresponds well with earlier findings (Jacobsen, 1984; Jenny and Prohek, 1986; Birkeland *et al*., 1997). Subjective norms for aesthetic and dental attractiveness and ambitions for their child's future possibilities are possible explanations, and further psychosocial studies are required.

Approximately 80 per cent of the children would undergo the same treatment again, even if satisfaction with the result was 95 per cent and that with own dental appearance 100 per cent. These discrepancies probably indicate that the burden of wearing appliances is substantial. A greater time span between the end of treatment and the evaluation might give better correspondence between these values. Another possibility is that those who expressed hesitation for re-treatment had rather low pre-treatment orthodontic concern, and had been advised to undergo treatment by their parents or the orthodontist. The percentage of parents who would advise their children to go through the same treatment again was at the same level (92.5 per cent) as the satisfaction with the treatment results.

The results indicate that both children and parents rate pleasant aesthetics as an important factor for psychosocial well being. In general this investigation shows that orthodontic treatment is accepted as an important part of the health service, and that both parents and their children are satisfied with the treatment result.

As the incidence of orthodontically treated persons increases, the dental appearance in general improves. It is likely that what is today regarded as a minor deviation might be considered a disturbing trait in years to come.

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