ORIGINAL ARTICLE

Effectiveness of early orthodontic treatment with the Twin-block appliance: A multicenter, randomized, controlled trial. Part 2: Psychosocial effects

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The aims of this project were to evaluate whether early orthodontic treatment with the Twin-block appliance for the developing Class II Division 1 malocclusion resulted in any psychosocial benefits. This multicenter trial was carried out in the United Kingdom, with 174 children aged 8 to 10 years with Class II Division 1 malocclusions randomly allocated to receive treatment with Twin-block appliances or to an untreated control group. Data were collected at the start of the study and 15 months later. Results showed that early treatment with Twin-block appliances resulted in an increase in self-concept and a reduction of negative social experiences. The subjects also reported treatment benefits that could be related to improved self-esteem. Further research is needed to determine the extent to which these effects translate into social behavior and experiences. (Am J Orthod Dentofacial Orthop 2003;124:488-95)

This is the second of 2 articles describing the findings of a multicenter, randomized, controlled trial investigating the effects of early treatment of Class II Division 1 malocclusion. The first described the results of morphological assessment; the second examines the psychosocial impact of early orthodontic treatment.

A main aim of orthodontic treatment is to correct or improve the esthetic appearance of the dentition and thereby enhance psychosocial functions and experiences for patients. The belief that orthodontic change influences psychosocial status has been primarily intuitive, resulting most probably from the evidence of a strong relationship between physical appearance and social attractiveness.[1] Further supporting this belief is the assumption that the teasing and negative stereotyping that are associated with a visible malocclusion result in low self-concept.[2] Although research indicates

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that "normal" dental appearance is socially preferable[3] and that malocclusion is related to negative social responses,[4] there is no strong support that orthodontic treatment in children causes significant changes in self-concept or increases in self-esteem.[5,6] For example, in a randomized, controlled trial of early orthodontic growth modification, Dann et al[7] found no change in self-concept as a function of early treatment. The self-concepts of 208 subjects with Class II malocclusions were measured before treatment with the Piers-Harris Children's Self-Concept Scale.[8] A subset of 87 of these children was measured again after 15 months of orthodontic growth modification treatment. Although mean self-concept scores were found to be above the population norms, no relationship was found between the self-concept scores and overjets. Importantly, treatment did not have an effect on the self-concept scores. The authors concluded that children with Class II malocclusions do not generally present for treatment with low self-concepts, and, on average, self-concept did not improve after orthodontic treatment. However, because the investigators did not intend to reduce the overjets of the early treatment patients (this was reduced by only a mean of 2 mm), it could be that the esthetic appearance of the children's teeth was not changed enough to have an impact on self-concept. An additional study limitation was the potential lack of generalizability because only children in the United States were examined.

The aim of our investigation was to examine children's perceptions of orthodontic treatment benefits and to evaluate the psychosocial effects of early growth modification treatment with the Twin-block appliance with the intention of reducing the overjets of a sample of British children.

The following hypotheses were tested: (1) the self-concepts and social experiences of children with Class II malocclusions are influenced by sex, socioeconomic status, features of the malocclusion, and whether they receive early orthodontic treatment with a Twin-block appliance; and (2) children undergoing early orthodontic treatment have realistic perceptions of the benefits of treatment.

MATERIAL AND METHODS

One hundred seventy-six children who came as orthodontic patients were recruited for this project; 89 (41 girls and 48 boys) were allocated to the Twin-block group and 87 (41 girls and 46 boys) to the control group. The average ages were 9.7 (SD = 0.98) years for the treatment group and 9.8 (SD = 0.94) years for the control group.

Details of the experimental design, study groups, and treatment methods were published in the earlier article.[9] Data were collected at baseline and 15 months later; at this point, no child was still wearing the Twin-block appliance.

The measures used in this study are described below. All questionnaires were completed in a quiet area of the clinical department, and no time limit was given for completion.

The Piers-Harris Children's Self-Concept Scale is a widely used measure of self-concept in children aged 8 to 18 years.[8] This 80-item forced choice, self-report measure yields a total score that assesses global self-concept and 6 cluster scores that reflect the self-concept domains of behavior, intellectual and school status, physical appearance, anxiety, popularity, and happiness and satisfaction. Higher scores indicate a higher self-concept. The reliability and validity of the Piers-Harris have been well established with moderate to high test-retest reliability and high levels of internal consistency. This measure was completed by the children (without parents) at the start of the study and 15 months later.

The Childhood Experience Questionnaire is a 20-item self-report instrument developed by Pertschuk and Whitaker to tap children's negative social experiences, such as teasing and being pitied.[10] This questionnaire is completed by the child and, while not formally validated, has been used in investigations of psychological effects of craniofacial anomalies.[10,11] Responses are made on a 5-point Likert scale and yield a total score, with lower scores representing more positive social experiences. This measure was completed by the children (without parents) at the start of the study and 15 months later.

To assess perceived orthodontic treatment benefits, we used a 23-item measure derived from a questionnaire that was developed in the United States to measure consumer perceptions of orthodontic treatment.[12] Although the original 52-item questionnaire has not been validated, it has been found to be a practical and reliable measure for use with orthodontic care consumers. In our modified questionnaire, subjects were asked to rate each item for how important it was to them. Ratings were done on a 4-point Likert scale with 1 = "not a reason" to 4 = "very much a reason." This questionnaire was completed by all subjects at the start of the study only.

A second questionnaire was given to the treatment group children. This was a modified version of the Perceptions of the Benefits of Orthodontic Treatment Scale; the phrasing of the items was changed to incorporate children's perceptions of treatment impact. For each item, the children were asked to rate how

much the item had changed as a result of treatment. Responses were made on a 4-point Likert scale with 1 = "no better" and 4 = "very much better." This measure was completed at 15 months after entry into the study.

Patient zip codes were obtained to determine social deprivation level with the Carstairs index.[13] This is a composite index of deprivation derived from national census data in the United Kingdom.

The overjet at the start of treatment was recorded from the patient's cephalograms.

Data analysis

We carried out an intention-to-treat analysis so that the data from all patients, regardless of treatment outcome, were included in the analysis. This comprised an analysis of all patients who entered the trial and for whom baseline and final records were available. The following variables were included at the start of the modeling process: baseline data on the dependent variable, treatment group, overjet at the start of treatment, age, Carstairs deprivation score, center and center*treatment group interaction term, sex and sex*treatment interaction term, and time from registration to first and second data collection.

The regressions were carried out with sums of squares type II. In none of the regressions was center or center*treatment group significant. When treatment group was significant, simpler models were found by removing nonsignificant variables. When variables were removed, the regression coefficients and adjusted R^2 values were compared with the previous model to check stability of effect. All models were tested for homogeneity of variance and normality of residuals. Models were constructed for the following outcome measures: Piers-Harris Children's Self-Concept Scale total score and each cluster score; and the Childhood Experience Questionnaire score.

We did not carry out pretreatment univariate analysis of the variables that we measured, because this is not current recommended statistical practice.[14] We did, however, fit the pretreatment values into the regression analysis.

The flow of patients through the study is shown in the Figure. This shows that there was some data loss. Three patients had no baseline questionnaires. Values for these and other missing baseline data were imputed with computer software (Stata, College Station, Tex). In addition, 17 patients in the treatment group (including 14 who did not complete treatment) and 10 in the control group did not fill in a questionnaire at 15 months. Also, 3 treatment group patients and 1 control patient did not fully complete their questionnaires; 5 patients in the treatment group and 6 in the control group were excluded because of detection of bias, inconsistent replies, and fake responses.

We then carried out a logistic regression with "missing/not missing" as the dependent variable. We included the following variables in the model: baseline Piers-Harris score, Carstairs deprivation score, age, sex, and treatment group. This showed that the only predictor of missing data at 15 months was a high Carstairs deprivation score. We then used the probability weights from this regression to weight the questionnaire scores. As a result, we compensated for the effect of data loss at 15 months.

RESULTS

Table I gives the means and 95% confidence intervals (CI) for the total score and the 6 cluster scores at the start and end of the study. At onset and at 15 months, mean self-concept scores for both treatment and control group children were higher than reported population norms. These mean scores reflected medium to high self-esteem for these groups.

Regression analysis results are reported in Table II. The results indicate that, when controlling for scores at baseline, the treatment group showed significantly better self-concept scores than the control group for global self concept (total score) and the domains of physical appearance, anxiety, popularity, and happiness and satisfaction. When we consider the size of the effect, it appears that Twin-block treatment results in increases in the total score by 4 points and in cluster scores from 0.99 to 1.4 for happiness and satisfaction and anxiety, respectively.

Data for the Perceptions of the Benefits of Orthodontic Treatment questionnaire were factor analyzed by using principal component analysis with a varimax rotation. The criterion for retention included an eigenvalue greater than 1. Reliability was assessed with the Cronbach α.

Results of the factor analysis yielded 5 main factors that accounted for almost 60% of the variance. We categorized these factors as "general well-being" (eigenvalue of 7.64, accounting for 34.7% of the variance), "confidence" (eigenvalue of 1.99, accounting for 9.0% of the variance), "health of teeth" (eigenvalue of 1.57, accounting for 7.1% of the variance), and "mouth function" (eigenvalue of 1.17, accounting for 5.4% of the variance). Other factors with lower eigenvalues were not retained, and items in these factors were dropped from subsequent analyses. The reliability of the factors, as measured by the Cronbach α, ranged from 0.86 for "general well-being" and "confidence" to 0.77 for "health of teeth."

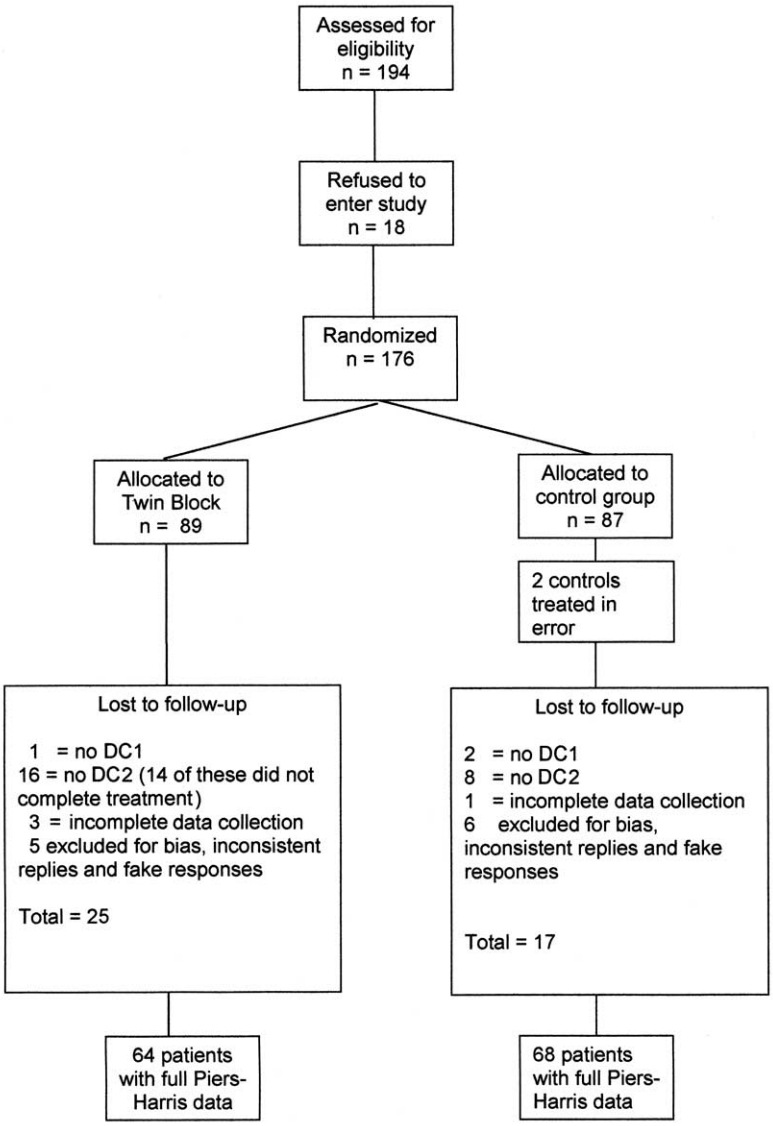

Fig. Flow of patients through study.

The means and standard deviations for the items included in each factor are given in Table III. This shows that the subjects thought that most of the potential benefits of orthodontic treatment would occur, with particularly high scores for benefits such as "feeling more confident," "feeling better about oneself," "looking better," "keeping gums healthy," and "helping keep front teeth together."

When we considered the data derived from the modified version of the Perceptions of the Benefits of Treatment part of this questionnaire, we calculated the percentage of children who thought each item had improved. This is shown in Table IV. Findings showed that most children thought that benefits were gained in the factors associated with confidence, health of teeth, and mouth function. Particularly high proportions of them reported to have benefited in the areas related to "the fit of their front and back teeth," "healthy gums," "feeling better about themselves," and "improvement in appearance."

The means and CI for the Twin-block group at the start and end of the study were 49.53 (95% CI = 47.58 to 51.49) and 44.99 (95% CI = 43.31 to 46.66), respectively. Means and CI for the control group were 47.68 (95% CI = 45.95 to 49.42) at the start and 46.18 (95% CI = 44.66 to 47.70) at the end of the study. The results of the regression analysis showed that the only variable, other than the baseline data, to have an effect

Table I. Piers-Harris scores for Twin-block and control groups at start of study (DC1) and 15 months later (DC2)

	Twin-block (n = 65)				*Control (n = 70)*			
	Before		*After*		*Before*		*After*	
	Mean	*95% CI*	*Mean*	*95% CI*	*Mean*	*95% CI*	*Mean*	*95% CI*
Total score	58.37	55.62 to 61.13	63.32	60.84 to 65.80	58.17	55.46 to 60.88	59.69	56.70 to 62.67
Behavior	13.68	13.08 to 14.28	14.20	13.68 to 14.72	13.28	12.61 to 13.95	14.03	13.43 to 14.63
Intellectual and school status	12.66	11.89 to 13.43	13.52	12.80 to 14.25	12.66	11.97 to 13.37	13.06	12.22 to 13.89
Physical appearance	7.83	7.16 to 8.49	9.23	8.60 to 9.86	8.34	7.66 to 9.02	8.24	7.52 to 8.96
Anxiety	9.52	8.77 to 10.27	10.84	10.14 to 11.54	9.39	8.57 to 10.20	9.57	8.70 to 10.44
Popularity	8.50	7.90 to 9.12	9.97	9.48 to 10.46	8.42	7.78 to 9.05	8.76	8.05 to 9.47
Happiness and satisfaction	8.14	7.61 to 8.66	8.94	8.60 to 9.27	8.35	7.83 to 8.88	8.05	7.57 to 8.54

Table II. Regression analysis of Piers-Harris Self-Concept scores

		Pretreatment score		*Twin-block treatment group*			
Dependent variable	*Intercept*	*Beta*	*Sig*	*Beta*	*Sig*	R^2	*Model significance*
Total score	21.12	0.67	<0.005	3.89	0.013	0.43	<0.005
Behavior	9.63	0.52	<0.005	-	0.87	0.37	<0.005
Intellectual and school status	6.46	0.70	<0.005	-	0.30	0.36	<0.005
Physical appearance	3.09	0.59	<0.005	1.33	0.002	0.32	<0.005
Anxiety	3.06	0.58	<0.005	1.37	0.006	0.31	<0.005
Popularity	2.85	0.61	<0.005	1.12	0.004	0.35	<0.005
Happiness and satisfaction	5.70	0.39	<0.005	0.99	<0.005	0.27	<0.005

Sig, Significance.

in the model was treatment (beta = −2.07 [CI = −4.00 to −0.17; $P = .033$; $R^2 = 0.3$]). We can, therefore, conclude that if a patient received treatment with a Twin-block appliance, the childhood experience score was reduced by 2 points.

DISCUSSION

The most important finding of this study was that children who received early orthodontic treatment with a Twin-block appliance reported higher self-concepts and more positive childhood experiences than did the controls who received no orthodontic intervention. However, both groups, at baseline and at 15 months, had self-concept scores that exceeded population norms. This is consistent with findings reported by Tung and Kiyak[5] and in surgical orthodontic studies,[15] suggesting that patients who desire orthodontic treatment tend to have a relatively high normal range of self-esteem. Although neither group fell within the low self-concept range, the increases in self-concept in the treatment group would be deemed encouraging from a treatment perspective. Further research is needed to determine the extent to which these differences in normal to high self-concept translate into social behavior, experiences, efficacy, and satisfaction.

Our findings of enhanced self-concept for treated patients do not support past findings.[5,7,16] This might reflect differences in samples (British children vs American children) and study treatment aims. For example, in the study by Dann et al,[7] the investigators did not seek to reduce the overjets, and labial bows were not placed on the bionator appliances. In our study, if the incisors were proclined, we used an active labial bow and reduced the overjet, leading to a mean reduction in overjet for the treatment group of 6.6 mm. This, of course, would result in an improvement to the appearance of the dental malocclusion and could have influenced psychosocial responses in a more dramatic way.

With respect to negative social experiences, our findings suggest that children who received the Twin-block intervention reported significantly fewer negative social experiences posttreatment. Additional research is needed to determine whether this is a detectable social difference at an individual level. However, the pattern of findings in this study suggests that Twin-block

Table III. Items, means, and SD for perceptions of benefits of orthodontic treatment scale for all children

Factor	*Item*	*Mean*	*SD*
General well-being	To make family happy	2.48	1.28
	To help me with my schoolwork	1.48	0.90
	To help my breathing	1.74	1.07
	To help me speak more clearly	2.40	1.17
	To make me healthier	2.31	1.18
	To help me make friends	2.10	1.21
	To make me feel better about going out	2.45	1.22
	To make it easier to get on with people	2.02	1.19
	To help keep my jaw joint from clicking	2.05	1.23
Confidence	To feel more confident	2.68	1.17
	To make my face look better	2.73	1.15
	To make me feel better about myself	2.72	1.17
	To help me make friends	2.10	1.21
	To make me look better	2.91	1.09
	To make it easier to get on with people	2.02	1.19
	To make me feel better about going out	2.45	1.22
Health of teeth	To keep me from losing teeth in the future	2.75	1.27
	To help my back teeth fit together	3.11	1.10
	To keep my gums healthy	2.94	1.09
	To make me healthier	2.31	1.18
	To keep my jaw joints healthy	2.99	1.06
	To help my front teeth fit together	3.63	0.75
Mouth function	To make it easier to bite into food	2.70	1.27
	To help me speak more clearly	2.37	1.18
	To help me chew food better	2.41	1.22

Table IV. Percentage of children who believed that each item had improved after orthodontic treatment

Factor	*Item*	*Children who felt improvement (%)*
General well-being	To make family happy	80.9
	To help me with my schoolwork	38.2
	To help my breathing	49.3
	To help me speak more clearly	69.6
	To make me healthier	64.2
	To help me make friends	46.4
	To make me feel better about going out	70.6
	To make it easier to get on with people	58.6
	To help keep my jaw joint from clicking	47.8
Confidence	To feel more confident	84.1
	To make my face look better	86.6
	To make me feel better about myself	85.5
	To help me make friends	46.4
	To make me look better	88.6
	To make it easier to get on with people	58.6
	To make me feel better about going out	70.6
Health of teeth	To keep me from losing teeth in the future	70.1
	To help my back teeth fit together	88.1
	To keep my gums healthy	83.8
	To make me healthier	64.2
	To keep my jaw joints healthy	81.2
	To help my front teeth fit together	90.0
Mouth function	To make it easier to bite into food	73.9
	To help me speak more clearly	69.6
	To help me chew food better	76.5

intervention could have influenced the psychosocial environment for the treatment group children.

Orthodontic Treatment Impact results were consistent with the aforementioned findings in that many treated children reported treatment benefits that could positively influence self-esteem including "feeling better about themselves" and "improvement in appearance." It is unclear whether these improvements were related to actual or perceived changes in malocclusion, or to other outcome variables.

It also appears that, although children have high expectations about orthodontic treatment benefits, these expectations can be somewhat unrealistic, particularly for the health improvements of teeth and gums; this is not borne out in the literature. Because of this, the orthodontist should carefully explore these expectations, particularly given the relationship between treatment expectations, outcomes, and patient satisfaction.

CONCLUSIONS

The results of this study suggest that early orthodontic treatment for Class II Division 1 malocclusion with a Twin-block appliance results in higher self-concept scores and fewer negative social experiences. The patients also reported treatment benefits that might be related to improved self-esteem.

REFERENCES

1. Arndt EM, Travis F, Lefebvre A, Niec A, Munro IR. Beauty and the eye of the beholder: social consequences and personal adjustments for facial patients. Br J Plast Surg 1986;39:81-4.
2. Shaw WC, O'Brien KD, Richmond S, Brook PH. Quality control in orthodontics: risk benefit appraisal in orthodontics. Br Dent J 1991;170:33-7.
3. Shaw WC, Rees G, Dawe M, Charles CR. The influence of dentofacial appearance on the social attractiveness of young adults. Am J Orthod 1985;87:21-6.
4. Shaw WC, Meek SC, Jones DS. Nicknames, teasing, harassment and the salience of dental features among school children. Br J Orthod 1980;7:75-80.
5. Tung AW, Kiyak HA. Psychological influences on the timing of orthodontic treatment. Am J Orthod Dentofacial Orthop 1998; 113:29-39.
6. DiBiase AT, Sandler PT. Malocclusion, orthodontics and bullying. Dental Update 2001;28:464-6.
7. Dann C IV, Philips C, Broder H, Tulloch JFC. Self-concept, Class II malocclusion, and early treatment. Angle Orthod 1995; 6:411-6.
8. Piers EV. Piers-Harris Children's Self-Concept Scale: revised manual. Los Angeles: Western Psychological Services; 1984.
9. O'Brien KD, Wright J, Conboy F, Sanjie Y, Mandall N, Chadwick S, et al. Effectiveness of early orthodontic treatment with the Twin-block appliance: a multicenter, randomized controlled trial. Part 1: dental and skeletal effects. Am J Orthod Dentofacial Orthop 2003;124:234-43.
10. Pertschuk MJ, Whitaker LA. Social and psychological effects of craniofacial deformity and social reconstruction. Clin Plast Surg 1982;9:297-306.
11. Thomas PT, Turner SR, Rumsey N, Dowell T, Sandy JR. Satisfaction with facial appearance among subjects affected by a cleft. Cleft Palate Craniofac J 1997;34:226-31.
12. Bennett ME, Michaels C, O'Brien KD, Weyant RJ, Philips C, Vig KWL. Measuring beliefs about orthodontic treatment: a questionnaire approach. J Public Health Dent 1997;57:215-23.
13. Carstairs V. Multiple deprivation and health service. Comm Med 1981;3:4-13.
14. Senn S. Statistical issues in drug development. Chichester (UK): Wiley; 1997. p. 95-105.
15. Kiyak HA, Bell R. Psychosocial considerations in surgery and orthodontics. In: Proffit WR, White RP, editors. Surgical-orthodontic treatment. St. Louis: Mosby Year Book: 1991. p. 71-91.
16. Albino JE, Lawrence SD, Tedesco LA. Psychological and social effects of orthodontic treatment. J Behav Med 1994;17:81-98.

COMMENTARY

This article comes from a landmark study that used contemporary methodology for qualitative evidence-based research. In a multicenter, randomized, controlled trial (RCT) approach, clinicians in many clinics in the United Kingdom followed standard protocols to provide early functional appliance (Twin-block) treatment for children aged 8 to 10 years old with Class II Division 1 malocclusions; the results were compared with age- and sex-matched samples. Unlike previous RCTs in the United States, which were designed with an *efficacy* approach in the early treatment of children, this study examined the *effectiveness* of early treatment intervention. In Part 1 of this article, the authors examined the dental and skeletal effects. Here, in Part 2, they examine the psychosocial effects of early intervention.

Psychosocial effects of early intervention were evaluated 15 months after enrollment for both groups. Demonstrable benefits were found by using robust statistical analyses in the treated group; these children had increased self-esteem and positive childhood experiences. Similar RCTs in the United States reported a reduced incidence of fractured incisors. Because the British study reduced the overjet completely in the subjects, it would be interesting to learn whether they also experienced fewer fractured incisors; a reduction in the number of missing or fractured teeth might also contribute to psychological well-being and self-esteem.

The British RCT began almost a decade after the US studies and included more contemporary functional appliances, thereby addressing 1 criticism of the US studies. This, together with full overjet reduction and the cross-cultural influence of the British population, might make it more difficult to generalize or make comparisons between the transatlantic RCTs. But repeated studies with similar protocols contribute to