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Psychosocial reward of orthodontic treatment in adult patients

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SUMMARY The purpose of this study was to assess the short-term psychosocial impact of dental aesthetic improvement in adult subjects.

Sixty-nine adult patients (61 females and 8 males, aged 21–59 years) requesting aesthetic dental improvement were prospectively and randomly recruited for the study in a private orthodontic office. A general interview included patient motivation and expectations from treatment. After clinical examination, discussion of the mode of treatment and the expected outcome, the patients were requested to complete the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) with several additions. The duration of their treatment was 6–14 months, and the main goals were tooth alignment, crowding alleviation, or space closure. After removal of the appliances, they completed an identical PIDAQ. Each patient served as his/her own control. Assessment of the impact of aesthetic improvement was based on the responses to the same questions relating to the patients' perceived dental aesthetics before and after treatment, their self-esteem, and changes in their social behaviour resulting from the treatment. The data were analysed using Cohen's and Pearson's correlation analyses and chi-square and Student's *t*-tests.

A statistically significant improvement ($P < 0.001$) was found for all four factors: dental self-confidence (DSC), social impact (SI), psychological impact (PI), and aesthetic concern (AC). The reliability of the questionnaire, using Cronbach's alpha, was between 0.709 and 0.947. The degree of significance was not related to age, marital status, education, or gender.

Dental aesthetics generated a significant improvement in adult patients' quality of life for the period examined (up to 6 months post-treatment).

Introduction

Aesthetics often plays a pivotal role in a patient's decision to seek orthodontic treatment, even in cases of clear medical necessity (Gosney, 1986). The motivation to improve one's aesthetics is clearly of a psychosocial origin (Peck and Peck, 1970). Does orthodontic treatment achieve this psychosocial goal?

Physical attractiveness is naturally a major contributor to self-esteem and thus affects one's overall sense of well-being. It is commonly appreciated that dental aesthetics contributes to physical attractiveness, physical health, and beauty (Giddon, 1995; Hunt *et al.*, 2001).

The positive relationship between physical attractiveness, health-related behavioural patterns, and appearance enhancement has been the subject of ongoing research (Jacobson, 1984; Patzer, 1997; Klages *et al.*, 2005).

Dental aesthetics is a key factor in overall physical attractiveness. High standards of living, together with increased longevity in the west, have led to a growing demand for orthodontic care in adults. Smile aesthetics has received exponentially growing attention from dental professionals leading to the emergence of a new speciality, designated 'aesthetic dentistry' (Goldstein, 1993). Periodontists attend to the gingival architecture of the anterior region, prosthodontists attend to the black triangles, black corridors, and emergence profile of crowns, and the role of the orthodontist in this integrated search for dental aesthetic perfection is vital.

Attempts to assess the impact of medical and dental conditions on subjective well-being have been made in several studies, using the health-related quality of life (HRQoL) instrument (Locker and Jokovic, 1996; Jokovic *et al.*, 2002). Since tooth malalignment is primarily an aesthetic inadequacy that does not usually cause pain or discomfort, this instrument has not been applied to patients with various malocclusions (O'Brien *et al.*, 1998; Cunningham and Hunt, 2001). Another proposed instrument, the oral health quality of life, was used to determine patients' expectations and experiences of fixed appliance therapy in children during orthodontic treatment. The results appeared more favourable during the treatment process than had been anticipated (Zhang *et al.*, 2007).

The HRQoL was also proposed to measure the impact of dental aesthetics on the subjective perception of well-being (McGrath and Bedi, 2001; Huppert and Whittington, 2003). Another instrument, the Orthognathic Quality of Life Questionnaire, was designed to test reliability, validity, and responsiveness of orthognathic patients with severe dentofacial deformities before orthodontic treatment, prior to surgery, and 6–8 weeks after the removal of fixed

appliances (Cunningham *et al.*, 2000, 2002). The authors claimed that the instrument provided some support for the contention that orthognathic patients improved their quality of life post-treatment.

In a prospective study of 40 adult patients followed during and shortly after the completion of orthodontic treatment, a significant overall facial and body image improvement was reported, though the psychological impact was unequivocal (Khan and Fida, 2008). Long-term impact on self-esteem was assessed recently by Kenealy *et al.* (2007). Those authors concluded that orthodontic treatment carried out at the age of 11–12 years had only a marginal effect on the psychological health and quality of life in adulthood.

What then is the impact of orthodontic treatment performed in the adult population on their sense of well-being? Is this impact solely based on clinically successful results or are there other factors involved which should be considered? In a recent study, Cunningham and Shute (2009) emphasised the importance of interaction and communication, both within the orthognathic team and between the team and the patient, to achieve optimum patient satisfaction.

Thus, the present study was undertaken to address patient satisfaction post-treatment and changes in their sense of well-being using a modified version of the questionnaire developed by Klages *et al.* (2006), for the assessment of the psychosocial impact of dental aesthetics in young adults. The four factors studied included dental self-confidence (DSC), social impact (SI), psychological impact (PI), and aesthetic concern (AC). Their results showed that this questionnaire met the criteria of 'factorial stability across samples and criterion-related validity and reliability'. This instrument was used on a sample of adults whose main complaint was cosmetic dental dissatisfaction in a prospective randomly designed study.

The objective of the present study was to test the hypothesis that orthodontic treatment in the setting of a private orthodontic office with a compassionate atmosphere has a positive impact on the subjective sense of well-being in an adult population with a wide age range, as expressed by the four-factor scale of the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ).

Subjects and methods

Sixty-nine adult patients [61 females and 8 males aged 21–59 years, mean 33.4 years (SD 9.5)] were prospectively and randomly recruited for the study. All patients were motivated to improve their dental aesthetics and requested orthodontic consultation for exploration of how their expectations could be met.

The reasons for seeking treatment were one or more of the following: (1) crooked teeth, (2) spaced teeth, (3) protruding jaw, or (4) dentist referral for orthodontic consultation for aesthetic improvement.

The subjects displayed a spectrum of intra-arch malalignments and inter-arch malocclusions. The majority of patients exhibited a Class I or Class II malocclusion with upper and/or lower anterior malalignment with various degrees of overbite and overjet. Two patients had a mild Class III malocclusion and lower anterior crowding.

The exclusion criteria were (1) presence of chronic diseases, (2) daily use of antidepressive medication, (3) presence of advanced periodontal disease, (4) maxillomandibular discrepancies requiring orthognathic surgery, or (5) orthodontic treatment with no aesthetic impact (e.g. molar uprighting or forced eruption).

All patients were requested to complete the PIDAQ (Figure 1) prior to the start of treatment. The version used in this study contained four items on demographic information regarding age, gender, education, and marital status. Twenty-eight items were clustered into five main groups; groups I–IV were based on the four factors of Klages *et al.* (2006) and group V included four questions on general beliefs regarding dental aesthetics.

Group I contained six items from the DSC factor scale; group II contained nine items: eight from the SI factor scale of Klages *et al.* (2006) and one additional item related to consciousness of the poor appearance of the teeth throughout the whole day, group III contained six items from the PI of dental aesthetics and group IV three items from the AC. Group V included four items related to patient beliefs concerning dental aesthetic impact on (1) dental health, (2) professional career, (3) social success, and (4) improvement in general appearance.

In order to avoid increased awareness of the patient to the factorial relevance of each question, the names of the factors were not specified on the relevant items in the questionnaire. All questionnaires were collected and kept until the completion of treatment.

Treatment utilised buccal or lingual fixed appliances and standard orthodontic treatment modalities in order to achieve optimal tooth alignment and articulation. Bonded anterior lingual retainers and upper Hawley appliances were used for retention.

During the active phase of the orthodontic treatment, the patients were given positive feedback and encouragement and were informed continuously about the progress of their treatment.

Shortly after appliance removal, each patient completed an identical questionnaire. All paired questionnaires before and after treatment for each one of the 69 patients were statistically analysed.

Statistical analysis

Statistical analysis was carried out using the Statistical Package for Social Sciences for Windows Release 14.0 (SPSS Inc., Chicago, Illinois, USA). Reliability analysis was conducted to assess the consistency of the four factor

Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ)

Personal information: Age ___, gender__, Education____, Marital status_____

The reason for seeking orthodontic treatment:

score from 1-5 (1- least and 5 - most appropriate)

- Crooked teeth
- Spaced teeth
- Protruding jaw
- Dentist referral

Dental Self Confidence I

- I am proud of my teeth
- I like to show my teeth when I smile
- I am pleased when I see my teeth in the mirror
- My teeth are attractive to others
- I am satisfied with the appearance of my teeth
- I find my tooth position to be very nice

Social Impact II

- I hold myself back when I smile so my teeth don't show so much
- If I don't know people well I am sometimes concerned what they might think about my teeth
- I am afraid other people could make offensive remarks about my teeth
- I am somewhat inhibited in social contacts because of my teeth
- I sometimes catch myself holding my hand in front of my mouth to hide my teeth
- Sometimes I think people are staring at my teeth
- Remarks about my teeth irritate me even when they are meant jokingly
- I sometimes worry about what members of the opposite sex think about my teeth
- I am conscious of the poor appearance of my teeth throughout the most of the day

Psychological Impact III

- I envy nice teeth of other people
- I am somewhat distressed when I see other people's teeth
- Sometimes I am somewhat unhappy about the appearance of my teeth
- I think most people I know have nicer teeth than I do
- I feel bad when I think about what my teeth look like
- I wish my teeth looked better

Aesthetic Concern IV

- I don't like to see my teeth in the mirror
- I don't like to see my teeth in photographs
- I do not like to see my teeth when I look at a video of myself

Patient Beliefs V

1. Do you think straight and beautiful teeth can promote dental health?
2. Do you think straight and beautiful teeth can promote your career?
3. Do you think straight and beautiful teeth can promote social success?
4. Do you think straight and beautiful teeth have a significant effect on your general appearance?

Figure 1 Psychosocial Impact of Dental Aesthetics Questionnaire.

scales by calculating Cronbach's alpha. To be evaluated as a reliable factor, an alpha of at least 0.70 was required. Correlations of each item with the sum of the remaining items in the same factor scale were calculated. Cohen's *d* and *T* values were determined to find the clinical relevance of any changes in the scores.

A Student's *t*-test was used to determine the influence of education, marital status, gender, and age on the PIDAQ scores for all four factors and also for the additional items in the questionnaire. A paired *t*-test was used to check the differences in the mean scores pre- and post-treatment for the four factor items (groups 1–4). Pearson's correlation was applied to test the relationship of age on pre- and post-treatment delta scores for the various factors (groups 1–4).

A Wilcoxon signed ranks test was used to assess whether there were any pre- and post-treatment differences regarding the four item beliefs of 'straight teeth benefit' in factor V, namely improved dental health, professional career, social success, and improved general appearance. A chi-square test was used to determine significance by comparing high-score (4 + 5) and low-score (1 + 2 + 3) respondents within each item either before or after treatment.

Results

Of the 69 subjects, 49.3 per cent were married and 50.7 per cent were single (divorced, not married, or widowed) and 18.8 per cent had a high school education and 81.2 per cent an academic education.

Patient motivation for treatment was for aesthetic reasons. Fifty-five patients (79.7 per cent) complained of 'crooked teeth', 39 (56.5 per cent) of spaces, and 38 (55.1 per cent) of a 'protruding jaw'. Thirty-two (46.4 per cent) had been referred by their dentist for similar aesthetic reasons. More than one answer could be marked in this section.

Since the Student's *t*-test did not reveal any gender differences between the groups, they were combined for further analysis.

Table 1 shows the mean scores for all items in the relevant group factor before and after treatment. All four factors pre- and post-treatment showed reliable Cronbach's alpha values between 0.709 and 0.947 and all four delta scores were highly significant ($P < 0.001$). Cronbach's alpha values for the DSC and AC before and after treatment were highest (0.947, 0.898, 0.890, and 0.886, respectively) and slightly lower but significant for SI and PI (0.709, 0.743, 0.760, and 0.719, respectively).

No differences were found between married and unmarried patients.

Education, however, had a minor impact on two of the four factors post-treatment; DSC and PI were significantly greater in the high school group ($P = 0.006$ and $P = 0.02$, respectively).

Pearson's test did not reveal any difference regarding age. Dividing the study group into 'younger' (21–30) and

'older' (31–59) subgroups also did not reveal any differences.

The reliability of each item of the 24 items clustered in the four-factor scale was evaluated. When an item was deleted and the value of Cronbach's alpha was higher than the mean factorial value, this item was considered 'problematic'. From all items, two items related to 'looking in the mirror' one in the DCS and one in the AC were problematic.

The frequencies of the four items in factor V before and after treatment are shown in Table 2.

Wilcoxon signed ranks test did not reveal any statistical differences before or after treatment in the four item beliefs, namely improved dental health, professional career, social success, and improved general appearance.

Chi-square testing showed significant differences between the high- (4 + 5) and low- (1 + 2 + 3) score respondents for the two item beliefs: improved dental health and improved general appearance, both before and after treatment ($P < 0.001$). After treatment, significance was also found for a third item: social success ($P = 0.003$).

Discussion

The findings of the present study support the contention that orthodontic treatment not only results in improvement in dental aesthetics but also has a significant impact on the psychosocial aspects of the patient's life. From the results of this prospective randomised study on four decades of age (twenties to fifties) the hypothesis was confirmed. Orthodontic treatment has a short-term positive impact on the subjective sense of well-being in both genders, married or unmarried, high school or academically educated, and younger and older subjects. Since each patient served as

Table 1 Paired mean scores for dental self-confidence (DSC), social impact (SI), psychological impact (PI), and aesthetic concern (AC) before and after treatment and their significance.

Pairs	Factors	Mean	*N*	Standard deviation	Delta	Cronbach's α	Cohen's *d*	*T*	*P*
Pair 1	DSC before	1.94	69	0.95	D_DSC	0.947	-2.18	-8.17	<0.001
	DSC after	4.48	69	0.55	-2.548	0.898			
Pair 2	SI before	2.26	69	0.67	D_SI	0.709	1.10	9.13	<0.001
	SI after	1.35	69	0.54	0.911	0.743			
Pair 3	PI before	2.87	69	0.88	D_PI	0.760	0.98	8.16	<0.001
	PI after	1.73	69	0.65	1.144	0.719			
Pair 4	AC before	3.83	68	1.10	D_AC	0.890	1.75	14.48	<0.001
	AC after	1.44	68	0.66	2.392	0.886			

Table 2 Frequency (number of respondents and their percentages) of scores (1–5) of four items of factor V, related to general beliefs (Figure 1), before and after treatment.

	Frequency	%	Frequency	%	Frequency	%	Frequency	%
	Before treatment							
	1		2		3		4	
1	7	10.1	8	11.6	3	4.3	2	2.9
2	1	1.4	7	10.1	5	7.2	1	1.4
3	4	5.8	20	29	19	27.5	7	10.1
4	12	17.4	10	14.5	16	23.2	13	18.8
5	45	65.2	24	34.8	26	37.7	46	66.7
Total	69	100	69	100	69	100	69	100
	After treatment							
	A		B		C		D	
1	10	14.5	9	13	5	7.2	4	5.8
2	0	0	4	5.8	3	4.3	1	1.4
3	7	10.1	18	26.1	14	20.3	6	8.7
4	13	18.8	14	20.3	21	30.4	17	24.6
5	39	56.5	24	34.8	26	37.7	41	59.4
Total	69	100	69	100	69	100	69	100

his/her own control, was treated in the same office by the same team (interaction and communication), and had the same internal and external factors (Cunningham and Shute, 2009), the significant differences in the mean values of all items in the four factor scales pre- and post-treatment resulting in patient satisfaction were extremely reliable.

Previous research has shown that females are more dissatisfied with the appearance of their dentition than males and focus on improved appearance as a reward (Shaw, 1981; Sheats *et al.*, 1998). Those studies also contained a higher percentage of females. The current sample followed the same trend, with a majority of females.

Some studies have questioned the psychosocial benefit of orthodontic treatment (Klima *et al.*, 1979; O'Regan *et al.*, 1991). However, these were cross-sectional where the pre- and post-treatment groups were different and the populations were younger. Statistically, it is clearly desirable that post-treatment results are paired with those pre-treatment to eliminate hidden variables, e.g. different personalities and circumstances. To date, there are no prospective randomised adult population studies related to orthodontic treatment that investigated these issues.

Interestingly, DSC showed the largest delta between the pre- and post-treatment questionnaire followed closely by AC, although the level of significance was high for all factors. This was probably due to correction of their main complaint—dental malalignment.

The aesthetic dental improvement after orthodontic treatment and the newly acquired level of confidence is probably reflected in more relaxed social behaviour and smiling without hesitation. An additional support to this finding is that factor V, the social success item, became significant post-treatment.

The effect on the psychological and the social parameters is subjective and other factors may also be involved. A critical role in a patient's mental satisfaction, in addition to professional performance, is the patient–doctor relationship. Patient and dentist interpersonal appraisals are most significant for the successful outcome of treatment in the patient's eyes and the appreciation of the result. This is true for many different disciplines in dentistry and aesthetic medicine (Carlsson, 2009; Cunningham and Shute, 2009).

In this study, all patients were treated in the same practice and by the same team. Active patient involvement in treatment advancement, positive feedback on the part of the orthodontist, and interchange of treatment experiences with other patients created a positive anticipation for treatment outcome. This atmosphere probably contributed to achieving patient satisfaction.

The PIDAQ is a reliable instrument that was found to 'meet the criteria of factorial stability across samples and criterion-related validity and reliability' (Klages *et al.*, 2006). From all items examined, only one relating to looking in the mirror presented a problem.

Analysing the reliability of each item, i.e. how the deletion of this item would affect the Cronbach's alpha, revealed that looking in the mirror was a problematic issue especially in factor IV of AC. One question that arises is why looking at photographs and/or a video are more reliable than when looking in a mirror. Occasionally, in a given set of circumstances, the orthodontic result does not coincide with the mental picture that the patient has (Hollywood smile). The mirror presents a close and concentrated look at one's anterior teeth that can reveal very minor imperfections, e.g. tooth size, shape and colour that do not match the ideal. In addition, some of the orthodontic improvement (torque, overjet reduction, etc.) cannot be appreciated. Another possible reason for this finding could be some degree of body dysmorphic disorder in some patients (Cunningham and Shute, 2009).

It would be of interest to repeat this study in the same study group of patients in a few years time and to compare the results of a new PIDAQ with the previous scores. Similar studies should be undertaken in patients undergoing restorative procedures in the anterior region.

Conclusion

Dental aesthetics generated a significant improvement in adult patients' quality of life for the period examined (up to 6 months post-treatment).

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