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Patients' perceptions, treatment need, and complexity of orthodontic re-treatment

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SUMMARY The aim of the present study was to investigate the subjective perception and objective treatment need and complexity of patients seeking orthodontic re-treatment. One hundred subjects (66 females, 34 males, age 26.7 ± 8.2 years) seeking re-treatment were asked to complete a questionnaire which was constructed based on pilot interviews with 15 patients. The questions focussed on treatment experiences, retention procedures following the first course of treatment, and expectations of and motivations for re-treatment. A visual analogue scale (VAS 0–10) was used. The 're-treatment' group was matched with an untreated control group by age, gender, and the first consultation date. The study models of both groups were scored with the Index of Complexity, Outcome, and Need (ICON). Analysis of variance was used for across-time comparisons of VAS scores of patient's perception of their dental appearance, paired *t*-test for comparisons of the motivation VAS scores between the first treatment and re-treatment, and Mann–Whitney test for comparisons between the re-treatment and control groups.

Eighty-eight patients (26.3 ± 8.4 years) completed the questionnaire. After the initial treatment, 36 per cent of the patients did not have any retention measures. The mean VAS scores for dental aesthetics at the start and end of the initial treatment were 2.3 ± 2.1 and 6.6 ± 2.7, respectively. The scores for the present situation and expected results of re-treatment were 4.1 ± 2.7 and 8.8 ± 1, respectively. These scores differed significantly from each other. Seventy-nine pairs of models were matched for evaluation of treatment need and complexity. The mean ICON scores of the re-treatment group were significantly lower than the controls (45 ± 21 versus 57 ± 24), the aesthetic component being the main contributing factor to this difference (25 ± 16 versus 36 ± 18). Both groups showed a treatment need (ICON > 43), with the untreated controls having a relatively higher complexity. These results indicate that patients seeking re-treatment had a good perception of dental aesthetics, strong motivation, and an objective treatment need.

Introduction

Interest in orthodontic treatment and provision of orthodontic care for adults has increased considerably over the past 20 years. Among all patient populations, there is a group who have had previous orthodontic treatment and decided to seek re-treatment. It has been shown that a subject's decision to seek orthodontic treatment is based on multiple factors (Tuominen *et al.*, 1994; De Muelenaere *et al.*, 1998; Birkeland *et al.*, 1999; Fernandes *et al.*, 1999). Decisions for re-treatment might be related to the fact that the results of the initial orthodontic treatment in adolescence were not ideal or satisfactory. The reasons behind this may be an unfavourable skeletal growth pattern during and after treatment, relapse after treatment, or insufficient compliance resulting in discontinuation thus compromising the initial treatment goals (Myrberg and Thilander, 1973; Berg, 1979). Decisions for re-treatment could also be related to increased self-perception of dental appearance (Gosney, 1986; Espeland and Stenvik, 1991a). As the incidence of orthodontically treated subjects has increased in the last decade, dental appearance in general has improved. It is likely that what was previously regarded as a minor deviation is today considered a trait which requires further treatment (Birkeland *et al.*, 2000).

It has been shown that satisfaction with dental appearance was only slightly higher in adults who had undergone previous treatment, and occlusal anomalies were present among both treated and untreated subjects (Stenvik *et al.*, 1997; Shaw *et al.*, 2007). Several studies reported a considerable amount of both objective and subjective treatment need in young adults with a previous history of orthodontic treatment (Kerosuo *et al.*, 2000; Lagerström *et al.*, 2000; Lilja-Karlander and Kurol, 2003). Compared with untreated subjects, the treated subjects had an equal amount of (Pancherz and Hahn, 1992; Bergström and Halling, 1996; Pietilä and Pietilä, 1996; Kerosuo *et al.*, 2000) or even a higher (Burgersdijk *et al.*, 1991) treatment need. However, not all patients with a history of orthodontic treatment seek re-treatment. Those who do may have a higher level of self-perception of dental aesthetics, with a good socio-economic status, and with or without an objective treatment need. To date, no study has been performed to evaluate these aspects in patients seeking orthodontic re-treatment.

Therefore, the aim of the present research was to evaluate orthodontic re-treatment in respect of patients' perception using a structured questionnaire and the Index of Complexity, Outcome, and Need (ICON; Daniels and Richmond, 2000; Firestone *et al.*, 2002). In other words, the questions were:

Who wants re-treatment? Why do they want it? Do they objectively need treatment?

Subjects and methods

The present study had two parts. The first was questionnaire based dealing with patients' perceptions of dental appearance, previous orthodontic treatment, and expected re-treatment; and the second, a model-based analysis of treatment need and complexity of these patients compared with a matched control group who had no history of orthodontic treatment and were seeking treatment for the first time. All patients were referred to the Department of Orthodontics, University Medical Centre Groningen, The Netherlands. Each patient signed an informed consent that he/she agreed to participate in the study.

Patients' perception—a questionnaire study

Fifteen randomly selected patients seeking re-treatment were interviewed by the same person (CB) who was trained in the relevant interview techniques. These interviews were recorded and a questionnaire was developed, with the help of an epidemiologist, to assess experiences of the initial treatment, retention protocols after the initial treatment, and motivation for, and expectations of, re-treatment. The questions (Appendix) were divided into multiple choice, yes/no answers, open questions, and visual analogue scales (VASs), with a range of 0 cm (very disappointed, not motivated, not important) to 10 cm (very content, very well motivated, very important). A VAS was chosen because it is an easily understood method of collecting information with particular advantages in its simplicity, sensitivity, and reproducibility (Gift, 1989; Hunt *et al.*, 2001). The questionnaire was sent to 100 consecutive patients (66 females, 34 males, age 26.7 ± 8.2 years) seeking re-treatment after their first consultation. The 15 patients used for the questionnaire construction were not included in the main study.

Treatment need and complexity—a study cast analysis

Study models were taken of the re-treatment patients who returned the questionnaire. For each patient in this sample, a control subject was matched for gender, age, and date of first visit, and study models were also taken of these individuals. The controls were consecutive patients referred for orthodontic treatment, without a history of previous treatment. The models of the sample and control group were assessed using the ICON by a calibrated orthodontist (CB). Intra-observer agreement was 0.95 (kappa) which was tested by assessing 30 sets of models twice with an 8 week interval. The ICON divides the complexity of treatment into five scales: easy (<29), mild (29–50), moderate (51–63), difficult (64–77), and very difficult (>77).

Statistical analysis

Analysis of variance was used for comparisons of VAS scores of the patient's perception of their dental appearance at the different time points (start and end of the first treatment, present, and end of re-treatment). A paired *t*-test was performed for comparisons of the motivation VAS scores between the first treatment and re-treatment. As the ICON scores were not normally distributed either in the re-treatment or control group, a Mann–Whitney test was used for comparisons between the two groups. The difference was considered significant at $P < 0.05$.

Results

The distribution of the subjects is shown in Figure 1. Of the 100 re-treatment patients, 88 (59 females, 67 per cent and 29 males, 33 per cent, mean age of 26.3 ± 8.4 years) returned the completed questionnaire (dropout 12 per cent). Of this sample, 79 patients (55 females, 70 per cent and 24 males 30 per cent) had complete diagnostic records. Nine decided to reconsider treatment after the first consultation, when information on cost, duration, etc., was provided. These nine patients therefore did not proceed to records and documentation and were excluded from the study model analysis (overall dropout 9 per cent).

Treatment history

Regarding the first treatment (mean age of subjects 12.2 ± 3.2 years), 31 per cent of the patients were treated by family dentists and 66 per cent by orthodontists; the remaining 3 per cent could not recall the treatment providers. The most frequent reason for the initial treatment was irregularity of teeth (49 per cent) and/or prominent upper anterior teeth (48 per cent). The most frequently used appliance was an upper (60 per cent) and/or a lower (48 per cent) fixed appliance and 45 per cent of the patients had full fixed appliances (Figure 2A). Both removable and fixed retainers were used at the completion of the first treatment. In 39 per cent of the subjects, the retainers had been in place for less than 5 years. The average number of visits to the practitioner to check the retainers was 1.6 ± 2.7. Thirty-six per cent of subjects reported that they did not receive any retention after initial treatment (Figure 2B).

Patients' perceptions

Of the 88 re-treatment patients who completed the questionnaire, 40 per cent were married or cohabiting and 60 per cent unmarried. Ninety-seven per cent had a high or moderate education level (university or college). Initiatives for the first treatment were mainly from family dentists (78 per cent) and for re-treatment mainly from patients themselves (92 per cent). The most frequent reason for considering re-treatment was remaining irregularity of the

teeth and/or prominent upper anterior teeth (68 per cent). Thirty two per cent of the patients were concerned about their facial appearance related to unsatisfactory dental aesthetics. The mean satisfaction VAS scores before the first treatment, the end result, the present appearance, and expectations of re-treatment differed significantly ($P < 0.05$) from each other (Figure 3A). The mean 'importance' score for the role of straight/beautiful teeth in facial aesthetics was 8.2 ± 1.3. The motivation score for re-treatment was 8.1 ± 2.4, which was significantly higher than that for the first treatment (6.5 ± 2.8, $P < 0.05$). Motivational aspects were also indicated by the different types of appliances patients were unwilling to wear for re-treatment (Figure 3B). Extraction therapy and orthognathic surgery were rejected by 7 and 12 per cent, respectively, of patients seeking re-treatment (Figure 3B).

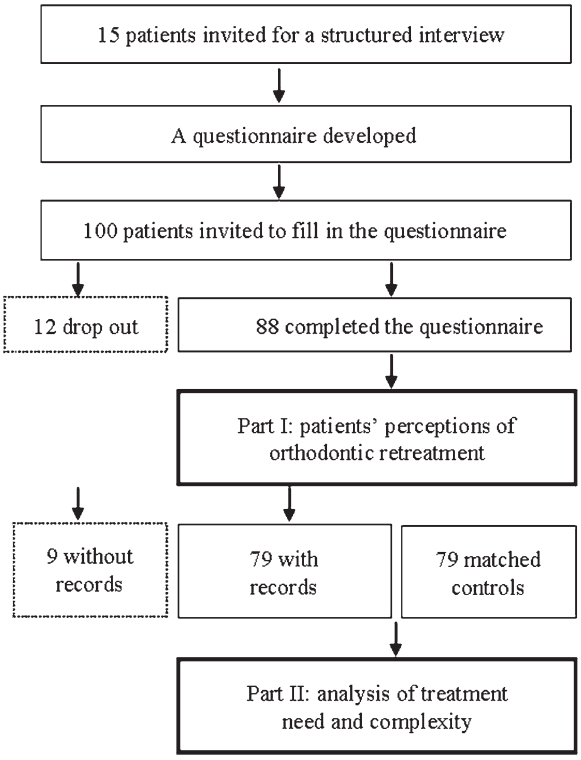

Figure 1 Flow chart of the study subjects.

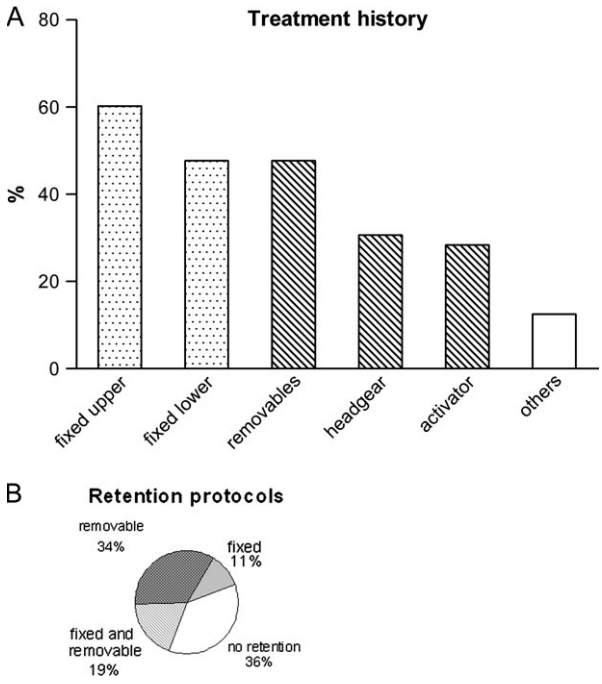

Figure 2 Treatment history by types of appliances (A) and retention protocols at the end of first treatment (B).

Objective treatment need and complexity

The average ICON score for the re-treatment sample was 45, which was significantly less than the value of 57 recorded for the untreated controls ($P < 0.01$). Both groups demonstrated a need for treatment based on an ICON score >43 (Daniels and Richmond, 2000). No significant differences between the occlusal components recorded for

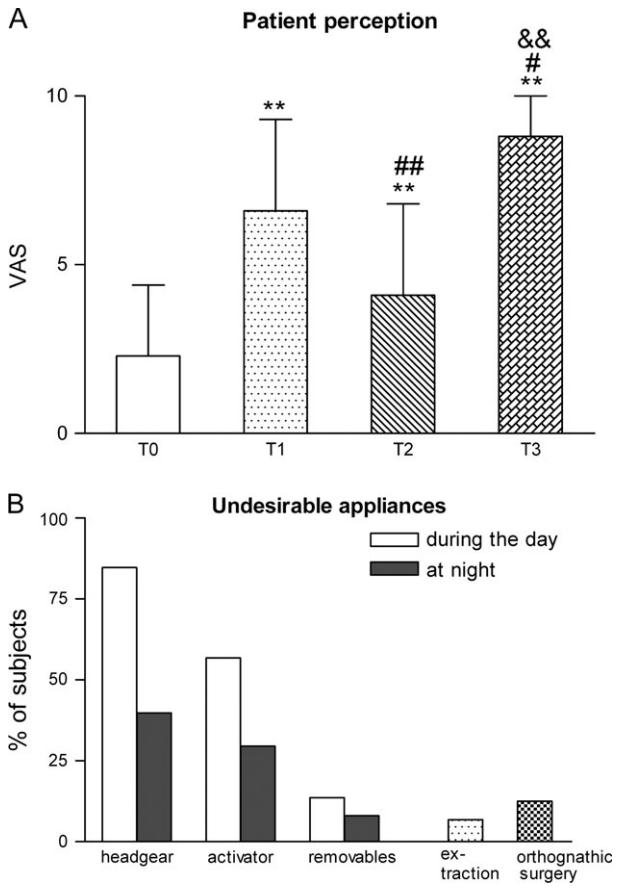

Figure 3 Patients' perceptions of dental appearance and orthodontic (re) treatment before the first course of treatment, at the end of initial treatment, currently, and expected results at the end of re-treatment (A). Undesirable re-treatment modalities (B). Comparisons between T1, T2, T3–T0; #between T2, T3–T1; and between T3–T2. *#& $P < 0.05$; **##&& $P < 0.01$.

the two groups were found, apart from the aesthetic evaluation of the occlusion which scored higher for the control group ($P < 0.01$; Figure 4A). More subjects in the control group (n = 22, 28 per cent) were graded 'very difficult' than in the re-treatment sample (n = 8, 10 per cent). There were more patients from the re-treatment sample in the easy (n = 18, 23 per cent) and mild (n = 38, 49 per cent) categories compared with the controls [9 easy (13 per cent) and 28 mild (36 per cent)]. The distribution among the moderate and difficult categories was similar in the two groups (Figure 4B).

Discussion

While an increasing number of patients are seeking orthodontic re-treatment, the characteristics of these patients have not been described in the orthodontic literature. This is the first study which has systematically evaluated the self-perception and objective treatment need and complexity of patients seeking orthodontic re-treatment. The findings provide important information to orthodontists about the perception and expectation of re-treatment patients, which adds to an interactive communication between patients and orthodontists. The study also provides data showing that re-treatment patients are not just whose with minor relapse. Objective treatment need and different levels of complexity exist in these patients.

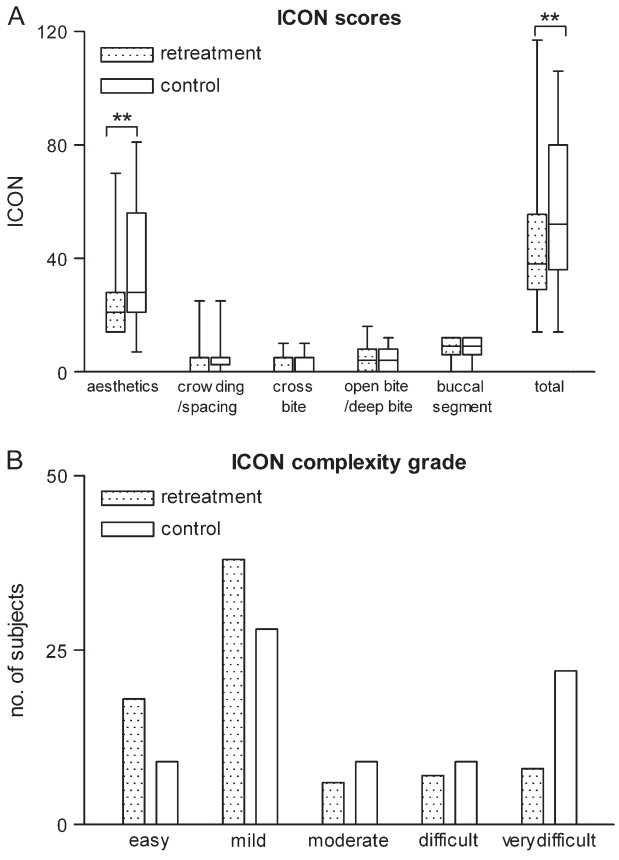

Figure 4 Treatment need and complexity (n = 79). Index of Complexity, Outcome, and Need (ICON) scores of each component and in total (A). ICON complexity grade (B). $^{**}P < 0.01$.

In many countries, general dentists carry out a varying proportion of orthodontic treatment, and studies have been published evaluating treatment outcome by general dentists, compared with orthodontists (Fox *et al.*, 1997; Berk *et al.*, 2002). The present research did not intend to address this aspect. The study only intended to indicate that, in the present cohort, the proportion of patients previously treated by general dentists or orthodontists was approximately the same as that found in The Netherlands as a whole i.e. about 40 per cent of orthodontic patients are treated by dentists and 60 per cent by orthodontists.

Different appliances were used during the first treatment, and in some subjects, a two-phase protocol was involved. These findings reflect the treatment approaches 10–15 years ago in The Netherlands. At the end of the first treatment, various types of retainers were used in 64 per cent of the patients. Different retention protocols and retainer appliance designs are variables to consider which may influence overall stability (Wong and Freer, 2005). However, since there is no consensus on retention protocols in the orthodontic literature, it is difficult to evaluate the appropriateness of the prescriptions. What is important to note is that 36 per cent of the patients did not receive any retention at the end of first treatment which is rather surprising, and this may have compromised the stability of the treatment results. However, a reporting bias may exist in that patients may have neglected to use the retainers as required.

The patients requesting re-treatment belong to an age group with a high level of dental concerns (Stenvik *et al.*, 1997). This has been confirmed by the present study, showing that patients consider straight teeth important in facial aesthetics. It is known that young adults have a more critical appraisal of orthodontic treatment need than other age groups (Helm and Petersen, 1989). In the present sample, a higher percentage of females presented for re-treatment than males. This agrees with a previous report and may be related to the fact that females consider straight teeth more important than males (Stenvik *et al.*, 1997). Compromised results due to lack of co-operation from the first treatment and increased awareness of dental appearance are possible motivational factors for seeking re-treatment (Sahm *et al.*, 1990; Bartsch *et al.*, 1993; Bergström *et al.*, 1998). A higher percentage of subjects who had been orthodontically treated reported a current subjective need for treatment. Orthodontic treatment may have raised their perceptions of the dentition (Tuominen *et al.*, 1994) and subjects who had undergone previous orthodontic treatment also show greater self-control and dental awareness than those who have not previously been treated (Klages *et al.*, 2005). In general, the public today attach great importance

to straight teeth (Bergström *et al.*, 1998). Patients with a previous treatment history are more likely to be aware of their own teeth and become easily dissatisfied with a developing tooth irregularity or malocclusion, compared with patients who have not had treatment (Klages *et al.*, 2005). Moreover, the present results indicate that these patients may also have developed a high perception of facial and profile appearance and are aware of the fact that dental irregularity may result in facial unattractiveness.

A disparity between the need and desire for orthodontic treatment has previously been reported (Sheats *et al.*, 1998; Riedmann and Berg, 1999; Tickle *et al.*, 1999; Linder-Aronson *et al.*, 2002). Socio-economic status affects normatively measured orthodontic treatment need through yet undefined mechanisms. It also affects a person's perception of treatment need. Previous studies have shown that orthodontically treated subjects report a higher perceived need for orthodontic treatment than those who are untreated (Burgersdijk *et al.*, 1991; Tuominen *et al.*, 1994). The fact that the present sample had a lower need for treatment than the controls may reflect an increased awareness of dental appearance. Kerosuo *et al.* (2000) reported a similar amount of treatment need in treated and untreated subjects, which is contrary to the present results. The reason could be that different indices were used. A previous Dutch study showed a somewhat higher need for treatment in those with a history of orthodontic treatment than those never treated (Burgersdijk *et al.*, 1991). This may be related to the large age range (15–74 years) in that sample and the tendency for treatment need and complexity may have increased with the age (Urtane *et al.*, 2006). The present results are in agreement with those of Espeland and Stenvik (1991b) who showed fewer malocclusions in young adults who had been treated. However, it has to be noted that none of the above-mentioned studies were on subjects seeking re-treatment, so comparisons are difficult to make.

The present study had several limitations. The sample size was relatively small. Nevertheless, it investigated some important characteristics of patients seeking re-treatment, on which future research could be based. Another limitation is that the patients may not have been able to accurately recall their perception of their dental appearance more than 10 years previously. However, the recall of previous treatment together with the expectation of re-treatment results could be used as references for patients' perceptions of current dental appearance.

Conclusions

Patients seeking re-treatment had a good perception of dental aesthetics and strong motivation. Their chief complaints were remaining dental irregularity, prominent upper anterior teeth, and/or an undesirable facial profile. These patients had an objective treatment need, indicated by the ICON scores.

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Appendix The questionnaire used (translated from the Dutch version).

Experience	
Multiple choice	Who was the first treatment provider (dentist/orthodontist)
	Who took the initiative for the first treatment? (dentist, yourself, family/friends)
	What was the main problem of your teeth? (crooked teeth, protruded upper teeth/jaw, retruded lower teeth/jaw)
	What kind of appliance did you have (removables, fixed appliance upper, fixed appliance lower, headgear)
Visual analogue scale	How would you score your teeth before the first treatment?
	How would you score your teeth at the end of first treatment?
	How would you score your teeth now?
	What would you expect from re-treatment?
Open question	How old were you at the start of first treatment? (year)
	How long did the treatment last? (months)
Retention	
Yes/no	Did you have a retention appliance after the first treatment?
	Did you wear the retention appliance as instructed?
	Did you get a fixed retainer behind the front teeth after first treatment?
Multiple choice	If you had a fixed retainer, was it (in the upper, in the lower, in both upper and lower)?
	How long was the fixed retainer in place? (<5 years, 5–10 years, until now)
Open question	How often did you visit the dentist/orthodontist for control of the retention?
Motivation	
Yes/no	Is extraction of teeth acceptable for you if necessary?
	Is jaw surgery acceptable for you if necessary?
Multiple choice	Who took the initiative for re-treatment? (dentist, yourself, family/friends)
	Which appliance would you be unwilling to wear during the day? (removables, fixed appliance upper, fixed appliance lower, headgear)
	Which appliance would you be unwilling to wear during the night?
	What is the acceptable duration of re-treatment?
Visual analogue scale	How much was your motivation for the first treatment?
	How much is your motivation for the re-treatment?
	How important do you think is the role of straight/beautiful teeth in facial aesthetics?