

ORIGINAL ARTICLE

Discomfort, expectations, and experiences during treatment of large overjet with Andresen Activator or Prefabricated Functional Appliance: a questionnaire survey

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ABSTRACT

Background: The purpose of this study was to investigate the amount of functional and social discomfort experienced after 1 and 6 months of appliance wear, comparing a slightly modified Andresen Activator (AA) and a Prefabricated Functional Appliance (PFA).

Methods: Ninety-seven patients randomly selected by lottery in an AA (40 subjects), and a PFA (57 subjects) group, with an Angle Class II, Division 1 malocclusion, were eligible for the study. One month and 6 months after start of treatment, a questionnaire, addressing discomfort, perception of treatment need and outcome, was used.

Results: The response rate was 69% after 1 month, and 45% after 6 months. The most common discomfort reported was the 'appliance falling out during sleep' followed by 'difficulties in remembering it'. The only difference was for pain, which was experienced more extensively in the AA group after 1 month of treatment. The dentist appeared to have the greatest impact on the decision to initiate treatment. Teasing, because of appearance, occurred in 13% of the cases.

Conclusions: No difference could be seen between groups for the experience of functional or social discomfort after 6 months of appliance use. Adequate time should be allowed for clarifying treatment difficulties, using treatment need as motivation.

Practical implications: The PFA eliminates the need for taking impressions. Furthermore, it can be economically advantageous to both patients and clinicians.

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Introduction

Orthodontic patients experience a varying degree of pain and discomfort during the course of treatment. Several studies show that even removable appliances may create discomfort, such as unpleasant tactile sensations, pressure on the oral mucosa, stretching of soft tissues, tongue displacement, soreness of teeth and pain [1–4]. Removable appliances may also induce functional impairment of speech, deglutition and breathing, or affect facial appearance [5,6]. These side effects act as adverse stimuli, and may disturb the process of adaptation and acceptance of the appliance [7].

Pain, functional and aesthetic impairment are the primary reasons for poor cooperation [3] and treatment discontinuation [5,8]. Clinical experience and research data indicate that patients may adapt to pain and discomfort during the progression of treatment as sensations cease, or recede from their focus of attention [9,10]. According to Brattström et al. [8], lack of information on pain and the effects of the appliance on oral function and facial aesthetics are the primary causes of treatment failure. Providing detailed information on discomfort that may occur and explaining how to reduce or eliminate it are vital factors for compliance [11]. Statements

from interviews, focusing on adolescents' experiences of removable functional appliances, showed that pain was experienced at the initiation of treatment. Improvement in the ability to wear the appliances occurred first after some weeks, after considerable efforts of adaptation [12].

The skeletal and dentoalveolar effects of functional appliances have been thoroughly studied, mainly by comparisons of different types of appliances. Only a few studies have evaluated pain, discomfort and acceptance associated with these appliances. According to Idris et al. [6] when comparing the Activator with the Trainer[®] (a prefabricated functional appliance), the main complaint during the first two weeks was speech impairment with the Trainer, and oral constraint with the Activator. Overall, pressure, teeth sensitivity, impaired speech and oral constraint were significantly higher for the Trainer group in comparison to the Activator group.

The purpose of this questionnaire survey based on a randomized controlled clinical trial was to investigate functional and social discomfort experienced during treatment with a slightly modified Andresen Activator (AA), and a Prefabricated Functional Appliance (PFA) (Supplementary Appendix 1). The null hypothesis was that pain, discomfort and acceptance were similar for both appliances.

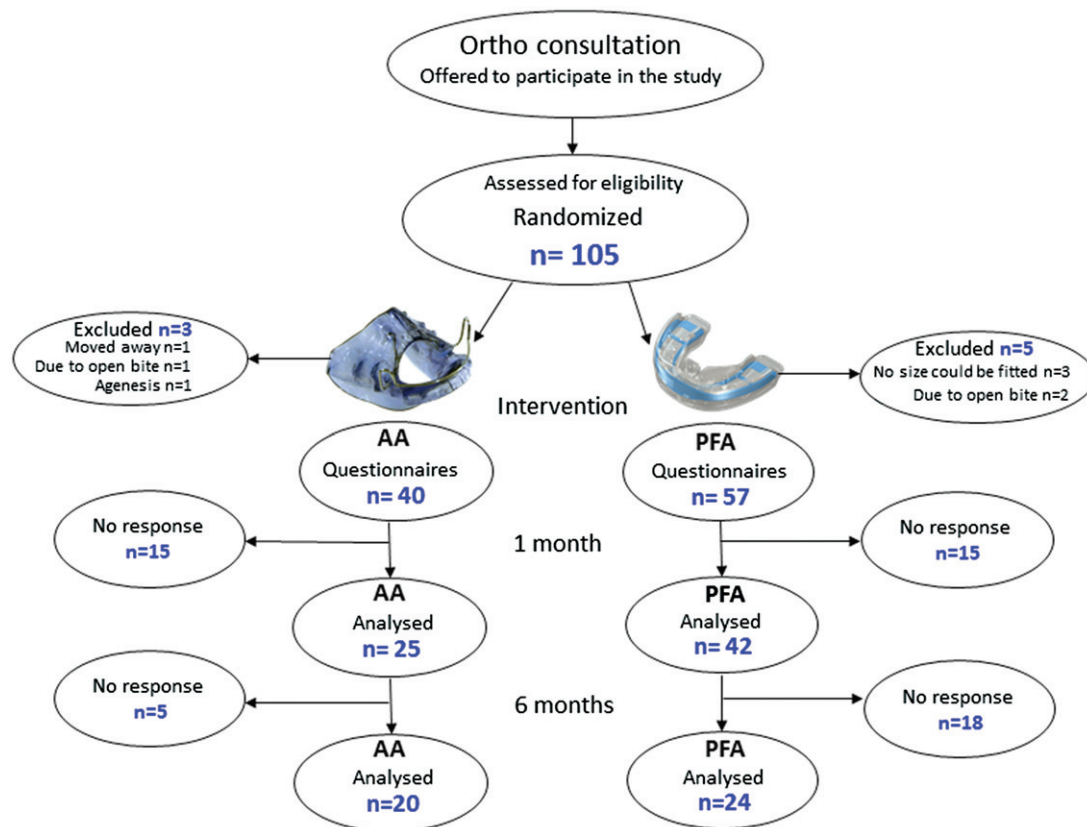


Figure 1. Flow chart of the participants in the study and questionnaire responses 1 and 6 months after the start of treatment.

It was also the intention of the study to investigate patient perception of treatment need, appliance acceptance, expectations of treatment influence on oral health, value of dental aesthetics and information concerning treatment procedures.

Methods

Trial design

Participants of this study are included in a multicentre, randomized, controlled trial investigating treatment of large overjet in Class II, Division 1 malocclusions, with a PFA and a more commonly used modified activator. Patients were randomly allocated by lottery to treatment with either a PFA or an AA (Figure 1). One and 6 months after the start of treatment, a questionnaire assessing discomfort, expectations and experiences was given to all patients. The Research Ethics Committee at the University of Gothenburg approved the study (Dnr: 437-07), and the guidelines of the Declaration of Helsinki were adhered to [13]. This trial was registered in 'FoU i Sverige' (<http://www.fou.nu/is/sverige>), registration number: 97131.

Detailed information on the trial design and treatment methods was published in a previous article [14].

Participants and randomization

Patients that fulfilled the inclusion criteria described below were invited to take part in the study, and informed written

consent was obtained from their parents. At each clinic, two envelopes were available, one for girls and one for boys, with 5 AA and 5 PFA notes for each. If all notes were used, 240 adolescents would be available for participation in the study.

Twelve general dental practices (GDP) in the Public Dental Health Services, Region Västra Götaland, were involved in the study. At each practice, one general dentist with special interest in orthodontics treated patients according to a standardized protocol. The patients were seen every 4–8 weeks. Twelve general dentists together with consulting orthodontists were all calibrated in the measuring procedures. The first author, (a consulting orthodontist) at the Orthodontic Specialist Clinic, monitored and coordinated the study.

The following inclusion criteria were applied: 6–14 years old patients with central incisors erupted, Angle Class II div 1, increased overjet ≥ 6 mm or less if lip incompetence was present, and no previous orthodontic treatment. Patients with crossbite, severe crowding, agenesis, other malocclusions or syndromes were excluded.

Interventions

The AA was a standardized, custom made, slightly modified AA, with an opening in the front region for mouth breathers. All AAs were made at the same orthodontic dental lab according to a given prototype (Figure 2). The general dentist only performed adjustments for erupting teeth on the AA at recalls.

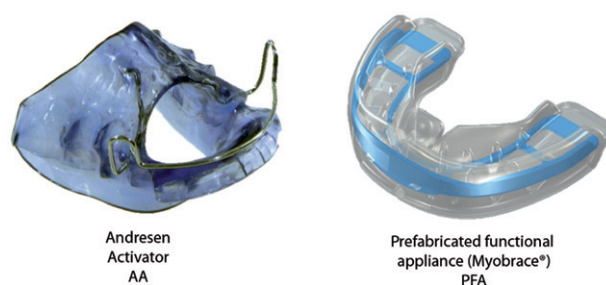


Figure 2. AA Standardized but custom made, slightly modified Andresen Activator with opening in the front for mouth breathers. PFA Prefabricated Functional Appliance (Myobrace®, Myofunctional Research Co, Australia).

The PFA, prefabricated, functional appliance (Myobrace®, Myofunctional Research Co, Australia) was available in seven sizes. The size of the appliance was chosen according to the manufacturer's recommendation. All PFAs were ordered from the same company (Figure 2). The general dentist needed no adjustments at recalls on the PFA.

Participants were instructed to use the appliance nightly, and 2 hours during the day, 12–14 hours in all.

In order to assess the amount of functional and social discomfort experienced during a short (1-month), and a long (6-month) period of appliance wear, a questionnaire was prepared. The questionnaire was designed and tested by experienced orthodontists at the Orthodontic Specialist Clinic in Gothenburg, Sweden who coordinated the study.

The questionnaire consisted of 13 items divided into three categories: open questions, questions with response categories and questions with a rating scale (VAS). Their purpose was to aid in examining patient perception of treatment need, initiation and expectations, dental aesthetics, problems regarding appliance use and information received before treatment. Questions covering the elements of feelings of tension or pressure, teeth sensitivity, the overall oral pain, speech impairment, swallowing difficulties, oral constraint and lack of confidence in public were also included in the questionnaire.

Questionnaires were distributed to patients at ordinary check-ups, 1 and 6 months after start of treatment. They were completed at the clinic or at home assisted by their parents. The completed questionnaires were then sent by prepaid mail to the first author (E. C). All questionnaires were answered anonymously. Information from the questionnaires was transferred to an Excel spread sheet (Microsoft Office Professional plus 2013).

Statistical analyses

Statistical analyses were performed in SPSS V22.0 (IBM SPSS Statistics, IBM Corp). Fisher's Exact Test was used to determine any significant differences in pain, discomfort and acceptance of treatment between the two groups AA and PFA. *p* values under 0.05 were considered statistically significant.

Responses from the rating scales (VAS) were divided into three equal segments: low (1), moderate (2) and high (3), and were used to determine the intensity of the problem as low, moderate or high. In order not to affect results,

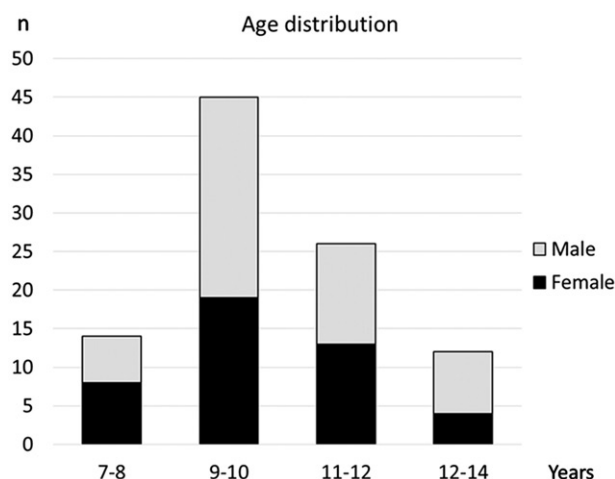


Figure 3. Participant age and gender.

borderline cases were summarized and divided equally between adjacent segments. In case of odd numbers of borderline answers, the last mark was distributed to the segment that would least influence the result. Calibration and mutual agreement in rating scale assessments were made on 20 randomly selected cases by the two observers (K. A, R. R) and the first author (E. C).

Due to anonymity, we were unable to analyze the failure of some participants to complete the questionnaire.

Results

Participant flow

Figure 1 illustrates the flow of participants throughout the study. It also shows some data loss. During the period 2007–2010, 105 patients agreed to participate in the study. Eight patients were excluded for various reasons, and the total sample (Figure 3) consisted of 97 subjects (44 girls, 53 boys), mean age 10.3 years (SD 1.64; range 7–14 years). The PFA and AA groups consisted of 57 subjects (28 girls, 29 boys), and 40 subjects (16 girls, 24 boys), respectively. No significant difference in age or gender was found between groups. Treatment effects have been published in a previous article [14].

Sixty-seven patients (69%) completed the 1-month questionnaire, and 44 (45%) completed the 6-month form. All questionnaires were completed anonymously. There were 25

(63%) questionnaires completed after 1 month by patients with activator (AA), and 42 (74%) with prefabricated devices (PFA). The 6-month questionnaire was completed by 20 (50%) AA and 24 (42%) PFA patients, as shown in Figure 1.

The most commonly reported problem was appliances falling out during sleep, followed by forgetting to insert them at night. These problems were described equally often in both groups (Figures 4 and 5). Overall oral pain was commonly reported, and social discomfort was a minor problem. Comparison between the two appliance groups for social and functional discomfort showed no statistically significant differences. Overall oral pain, however, was reported as significantly higher in the AA group than in the PFA group (Figure 4). The results after 6 months of treatment showed no statistical significant differences between groups (Figure 5).

Dentists seemed to have the largest impact (51%) on the decision for orthodontic treatment followed by mothers and patients themselves (21%). Only 6% were influenced by fathers. In approximately 30% of cases, friends, followed by mothers and dentists, had observed that teeth were mal-positioned. Teasing due to dental appearance occurred in 13% of cases, with the most common harassment to the patients being 'Rabbit teeth' (89%).

Expectations of improved oral health, and enhanced dental aesthetics by treatment, were high. Even the prophylactic treatment aim was highly regarded (Figure 6).

Patient dissatisfaction with teeth focused mainly on appearance (24%), and very little on function (1%), while many were satisfied (37%) with their teeth. However, some patients misinterpreted this open question (34%), and answers were incorrectly related to opinions of the orthodontic appliance. The most frequent problem experienced during treatment was the appliance falling out during sleep, followed by pain, and difficulties remembering to use it. Social discomfort on the other hand appeared to be minor (Figure 4). Findings in general did not change over time, i.e. results were nearly similar after 1 and 6 months of treatment (Figure 5).

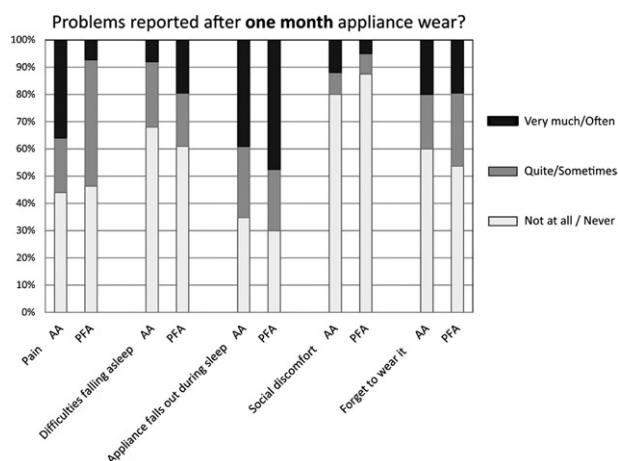


Figure 4. A comparison between the AA (Andresen Activator) and the PFA (Prefabricated Functional Appliance) in experiences of discomfort with these appliances reported after 1 month of treatment. No significant difference was found between the groups except for pain that was significantly higher ($p = 0.008$) in AA group than PFA.

In the open questions, problems associated with appliance usage were described. The most common problem stated was soreness, followed by e.g. statements such as 'You can't talk', 'Can't close your mouth while asleep' and 'It smells a bit disgusting'. At the 6-month follow-up, responses were similar, except for problems with appliance breakage, not mentioned in the earlier stage.

Knowledge of problems that could occur during treatment seemed good, especially of pain, and the risk of the appliance falling out during sleep (Figure 7).

Patients appeared to be well informed about recommended appliance user time and care. They were least informed on what to do in case of appliance breakage, or the appliance falling out during sleep (Figure 8). On the open question about: *What would you like to change in the patient information and motivation material*, 93% answered that they were happy with it as it was.

More than 10% frequently forgot to use their appliances, and almost 45% forgot it occasionally (Figure 9). The most frequently requested information wished for by patients was advice on what to do if the appliance fell out during sleep.

Harms

No adverse incidences were detected during the study.

Discussion

In the present study, data were collected with a specially designed questionnaire consisting of both scale rated and open questions. Open questions were added to strengthen the study wherein participants could express treatment experiences more freely. Questionnaires were handled anonymously without registration of the patient, clinic or dentist. This procedure, however, made it impossible to follow changes in discomfort over time for each participant, or analyze why some participants failed to complete the questionnaire. Variations in participant age may have influenced outcome. Still, the aim was, despite age differences, to

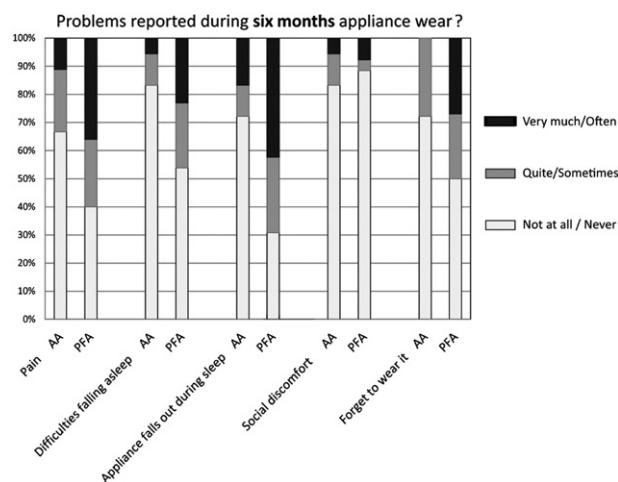


Figure 5. A comparison between the AA (Andresen Activator) and the PFA (Prefabricated Functional Appliance) in experiences of discomfort with these appliances reported after 6 months of treatment. No significant difference was found between groups.

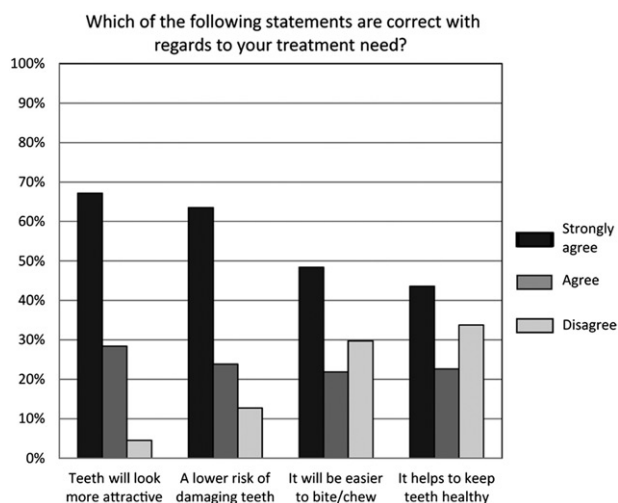


Figure 6. The patient's perception of why their need for treatment, expectations of treatment influence on oral health and value of dental aesthetics.

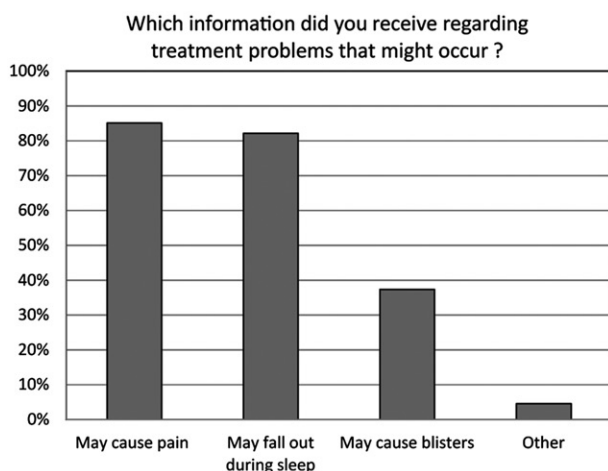


Figure 7. Information about problems recalled possibly associated with treatment. Category 'Other' describes e.g. 'Headache' and 'Not everybody has pain'.

investigate the patient's own experience, although they could receive some help from their parents concerning question interpretation. Age variation is normal, since removable functional appliances are generally used for both early and late mixed dentition, which will include individual variations from approximately 7 to 14 years of age, depending on somatic and dental development [4,6].

Twelve general practitioners were involved in the study, but all worked according to a systematized protocol and standardized appliances. Treatment outcomes from a larger number of operators make patient-related treatment outcomes more general than if only one or two clinicians had provided treatment in a university environment.

One could argue that the response rate was low, with 69% of the 1-month, and 45% of the 6-month questionnaires completed. However, if all questionnaires were to be completed at the clinic, the response rate could have been higher. No scientifically proven minimum response rate was found in the literature, but 60% has been used as a level of adequacy [15]. Paper-designed surveys have demonstrated higher response rates compared to electronically controlled surveys [16,17].

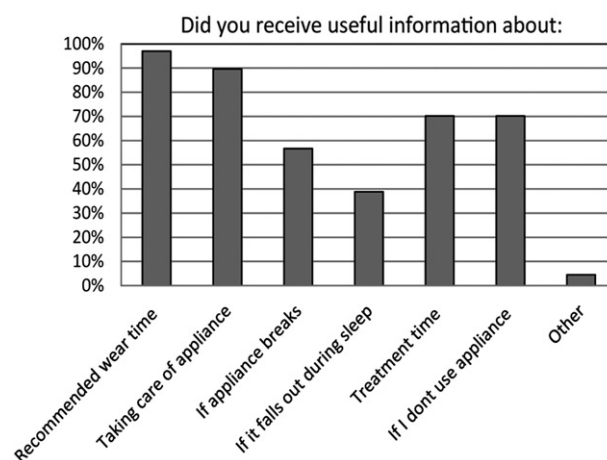


Figure 8. Patient perception of provided information for each area.

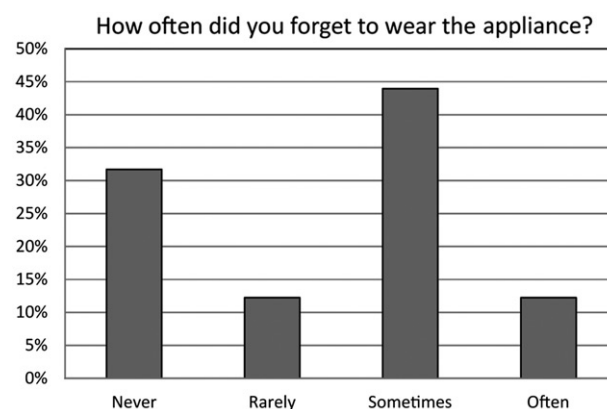


Figure 9. The frequency of patients forgetting to use the appliance.

Reasons for low patient compliance presented in previous studies include pain (28%), dissatisfaction with appearance (16%) and functional restrictions (7%) [5]. In addition, Bartsch et al. [18] found a correlation between the amount of orthodontic discomfort and patient compliance. In the present study, 45–55% of subjects complained about pain, especially during the first month of appliance wear (Figures 4 and 5). Oliver et al. [5] found no difference in pain perception between fixed and removable appliances, while Heinen et al. [19] noted that the majority of patients and parents preferred removable appliances to fixed appliances in patients that had used both.

The results of the current study show significantly higher overall oral pain perception for the AA group during the first month of treatment. A relatively small sample in the 6-month group may have influenced results, but not even merging the results of 'very much' and 'often and sometimes', and comparing them with 'no problems at all' showed any statistical significant differences between the two groups. Idris et al. [6] reported similar results regarding pain between a modified AA and a prefabricated appliance. On the other hand, the present study showed no difference in acceptance between the two appliances, which is in contradiction to the findings by Idris et al. [6], who found that the AA was more accepted than the Trainer appliance (another kind of PFA), in treatment of Class II Division 1 malocclusion in adolescent patients.

During the first 6 months of treatment, patients reported difficulties keeping the appliances in their mouths while sleeping, insignificantly more in PFA (70%) than in the AA group (30%). This can be compared with impaired sleep reported in 86% of patients treated with a functional appliance [20]. This could be the reason for patients, perhaps subconsciously, spitting out the appliance at night. However, discomfort and awkward effects from pressure and muscle tension in the muscles and mucosa caused by the functional appliances [2] could also be factors explaining the low compliance reported in connection with removable functional appliances [4,14,21,22].

According to Crawford [23], most adolescent patients base their wish for orthodontic treatment on aesthetics, rather than function. This is in agreement with our results where patient dissatisfaction seemed due to appearance (24%), not function (1%). This question was however misinterpreted by some patients, but as it was an open question it was quite obvious that misinterpretation was caused by linguistic similarities in the Swedish language. The differences between findings for appearance and function were however very obvious.

Previous studies have shown that the general practitioner often awakens interest for orthodontic treatment. Brattström et al. [8] reported that in 61% of a group of orthodontic patients, the initiative to commence treatment was made by the general practitioner. In our study, the general practitioner also seemed to have the largest impact (51%) on the decision to start orthodontic treatment, followed by mothers and patients themselves (21%).

It has previously been shown that children considered by some as unattractive are more likely to be the victims of bullying, and dental deviation appears to cause a substantial amount of teasing [24,25]. In a cross-sectional study of 336 adolescents in the UK, aged between 10 and 14 years, the prevalence of bullying was reported at 12.8%. Being bullied was significantly associated with Class II Division 1 and increased overjet and overbite [25]. In another group of adolescents awaiting orthodontic treatment, the prevalence of teasing related to dental appearance was reported to be 15% [26]. Prominent incisors were overrepresented with nicknames such as 'Goofy, Bugs Bunny, and Sticky out teeth' [24,27]. This is in accordance with our study, where teasing due to teeth appearance occurred in 13% of cases, with the most common phrase for harassment being 'Rabbit teeth' (89%).

An important finding of the study of early treatment with a Twin-block appliance was an increase in self-esteem and a reduction of negative social experiences [28]. In this respect, the contribution of orthodontic treatment should not be underestimated when a noticeable dentofacial deviation leads to hurtful mockery and bullying by peers.

It has been shown that patients who were positively motivated for treatment, or were aware of probable pain and discomfort, reported significantly less pain [20]. Brattström et al. [8] found that an initial lack of information concerning expected discomfort during treatment was considered the primary reason for premature

termination of treatment. Therefore, sufficient time should be allowed to explain the purpose and intention of the treatment, and to provide advice if the appliance tends to fall out during sleep, using treatment need for motivation. According to a previous study, active involvement of the patient, motivated parents with an understanding and encouraging clinician were all suggested to increase the chances of successful treatment [12]. These aspects should be considered in treatment timing and planning. In conclusion, the null hypothesis could not be rejected, except for the overall oral pain during the first month, as the modified AA seems to create more pain than a PFA during the initial phase of treatment.

Conclusions

- The most common discomfort, equally described in both groups, was the appliance falling out during sleep followed by difficulties in remembering to insert it at bedtime. Sufficient time should be allowed to explain the severity of the treatment, and provide advice if the appliance falls out during sleep, using treatment need for motivation.
- The dentist seemed to have the greatest impact on the decision to start orthodontic treatment, followed by mothers and the patients themselves. The contribution of orthodontic treatment in victimization should not be underestimated, whereby teasing due to teeth appearance occurred in 13% of cases.
- The null hypothesis could not be rejected, except for the overall oral pain during the first month, as the modified AA seemed to cause more pain than a PFA during the initial phase of treatment.

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Disclosure statement

The authors report no conflicts of interest.

Notes on contributors

Emina Ćirgić, is a PhD resident in Institute of Odontology. She has contributed to conception and design of the work, acquisition of data, analysis and interpretation of data. She involved in drafting and revising the manuscript and also in submitting of article.

Heidrun Kjellberg, is an Associate Professor in Department of Orthodontics, University Clinics of Odontology. She has contributed to conception and design of the work and also assisted in the interpretation of the results and revised the manuscript.

Ken Hansen, is an Associate Professor in Department of Orthodontics, University Clinics of Odontology. He has contributed to conception and design of the work and also assisted in the interpretation of the results and revised the manuscript.

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References

- [1] Johnson PD, Cohen DA, Aiosa L, et al. Attitudes and compliance of pre adolescent children during early treatment of Class II malocclusion. *Clin Orthod Res*. 1998;1:20–28.
- [2] Serogl HG, Klages U, Zentner A. Pain and discomfort during orthodontic treatment: causative factors and effects on compliance. *Am J Orthod Dentofacial Orthop*. 1998;114:684–691.
- [3] Egolf RJ, BeGole EA, Upshaw HS. Factors associated with orthodontic patient compliance with intraoral elastic and headgear wear. *Am J Orthod Dentofacial Orthop*. 1990;97:336–348.
- [4] Hedlund C, Feldmann I. Success rate, costs and long-term stability of treatment with activator/headgear combinations. *Swed Dent J*. 2016;40:67–77.
- [5] Oliver RG, Knapman YM. Attitudes to orthodontic treatment. *Br J Orthod*. 1985;12:179–188.
- [6] Idris G, Hajeer MY, Al-Jundi A. Acceptance and discomfort in growing patients during treatment with two functional appliances: a randomised controlled trial. *Eur J Paediatr Dent*. 2012;13:219–224.
- [7] Serogl HG, Zentner A. A comparative assessment of acceptance of different types of functional appliances. *Eur J Orthod*. 1998;20:517–524.
- [8] Brattström V, Ingelsson M, Aberg E. Treatment co-operation in orthodontic patients. *Br J Orthod*. 1991;18:37–42.
- [9] Gosney MB. An investigation into factors which may deter patients from undergoing orthodontic treatment. *Br J Orthod*. 1985;12:133–138.
- [10] Jones M, Chan C. The pain and discomfort experienced during orthodontic treatment: a randomized controlled clinical trial of two initial aligning arch wires. *Am J Orthod Dentofacial Orthop*. 1992;102:373–381.
- [11] Doll GM, Zentner A, Klages U, et al. Relationship between patient discomfort, appliance acceptance and compliance in orthodontic therapy. *J Orofac Orthop*. 2000;61:398–413.
- [12] Cirgic E, Kjellberg H, Hansen K, et al. Adolescents' experiences of using removable functional appliances. *Orthod Craniofac Res*. 2015;18:165–174.
- [13] Association WM. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA*. 2013;310:2191–2194.
- [14] Cirgic E, Kjellberg H, Hansen K. Treatment of large overjet in Angle Class II: division 1 malocclusion with Andresen activators versus prefabricated functional appliances—a multicenter, randomized, controlled trial. *Eur J Orthod*. 2016;38:516–524.
- [15] Johnson TP, Wislar JS. Response rates and nonresponse errors in surveys. *JAMA*. 2012;307:1805–1806.
- [16] Yarger JB, James TA, Ashikaga T, et al. Characteristics in response rates for surveys administered to surgery residents. *Surgery*. 2013;154:38–45.
- [17] Seguin R, Godwin M, MacDonald S, et al. E-mail or snail mail? Randomized controlled trial on which works better for surveys. *Can Fam Physician*. 2004;50:414–419.
- [18] Bartsch A, Witt E, Sahm G, et al. Correlates of objective patient compliance with removable appliance wear. *Am J Orthod Dentofacial Orthop*. 1993;104:378–386.
- [19] Heinen M, Kahl-Nieke B, Pies S, et al. A retrospective examination of the acceptance of removable appliances. *Fortschr Kieferorthop*. 1994;55:290–296.
- [20] Kavaliauskiene A, Smailiene D, Buskiene I, et al. Pain and discomfort perception among patients undergoing orthodontic treatment: results from one month follow-up study. *Stomatologija*. 2012;14:118–125.
- [21] Rizell S, Svensson B, Tengstrom C, et al. Functional appliance treatment outcome and need for additional orthodontic treatment with fixed appliance. *Swed Dent J*. 2006;30:61–68.
- [22] Sepanian VF, Paulsson-Björnsen L, Kjellberg H. A long-term controlled follow-up study of objective treatment need on young adults treated with functional appliances. *Swed Dent J*. 2014;38:39–46.
- [23] Crawford TP. A multiple regression analysis of patient cooperation during orthodontic treatment. *Am J Orthod*. 1974;65:436–437.
- [24] 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.
- [25] Seehra J, Fleming PS, Newton T, et al. Bullying in orthodontic patients and its relationship to malocclusion, self-esteem and oral health-related quality of life. *J Orthod*. 2011;38:247–256. quiz 294.
- [26] O'Brien C, Benson PE, Marshman Z. Evaluation of a quality of life measure for children with malocclusion. *J Orthod*. 2007;34:185–193. discussion 176.
- [27] Al-Bitar ZB, Al-Omari IK, Sonbol HN, et al. Bullying among Jordanian schoolchildren, its effects on school performance, and the contribution of general physical and dentofacial features. *Am J Orthod Dentofacial Orthop*. 2013;144:872–878.
- [28] O'Brien K, Wright J, Conboy F, et al. Effectiveness of early orthodontic treatment with the Twin-block appliance: a multicenter, randomized, controlled trial. Part 2: psychosocial effects. *Am J Orthod Dentofacial Orthop*. 2003;124:488–494. discussion 494–485.