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ORIGINAL ARTICLE

Duration of surgical-orthodontic treatment

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Abstract

Objective. To study the duration of surgical-orthodontic treatment with special reference to patients' age and the type of tooth movements, i.e. extraction vs. non-extraction and intrusion before or extrusion after surgery to level the curve of Spee. ***Material and methods.*** The material consisted files of 37 consecutive surgical-orthodontic patients. The files were reviewed and gender, diagnosis, type of malocclusion, age at the initiation of treatment, duration of treatment, type of tooth movements (extraction vs. non-extraction and levelling of the curve of Spee before or after operation) and type of operation were retrieved. For statistical analyses two sample t-test, Kruskal-Wallis and Spearman rank correlation tests were used. ***Results.*** Mean treatment duration of the sample was 26.8 months, of which pre-surgical orthodontics took on average 17.5 months. Patients with extractions as part of the treatment had statistically and clinically significantly longer treatment duration, on average 8 months, than those without extractions. No other studied variable seemed to have an impact on the treatment time. ***Conclusion.*** The present small sample size prevents reliable conclusions to be made. However, the findings suggest, and patients should be informed, that extractions included in the treatment plan increase chances of longer duration of surgical-orthodontic treatment.

Key Words: *Age, duration, extraction, orthodontics, surgery*

Introduction

Combined orthodontic and surgical treatment is the routine of choice for many non-growing patients who have dento-skeletal malocclusion. In most cases, orthodontics is needed before and after the operation. The aim of preoperative orthodontics is to eliminate dental compensation of skeletal discrepancies and to coordinate the upper and lower dental arches to facilitate placement of upper and lower jaws to a stable new position at the time of surgery, while the aim of postoperative orthodontics is to finalize the occlusion and provide optimal stability and esthetics.

As patients for surgical-orthodontic treatment are usually adults, the duration of treatment is an important issue when making the decision whether or not to start the treatment. Furthermore, it is known that a considerable number of orthognathic patients consider either pain or esthetic appearance of the braces the most disturbing part of the treatment [1]. As close an estimate as possible of treatment time should be included in the informed consent, since the patient's final satisfaction is known to be related to the accuracy of the information given [2]. Factors proposed as having an impact on the duration of surgical-orthodontic treatment include socio-demographic characteristics (age, gender), cooperation of the patient, type of malocclusion, treatment method, and experience of the orthodontist [3,4].

Our aim was to study the duration of surgical-orthodontic treatment, paying special attention to the age of patients and the types of tooth movement, i.e. extraction versus non-extraction and intrusion before or extrusion after surgery to level the curve of Spee. It was assumed that extraction treatment and preoperative levelling of the curve of Spee would lengthen treatment time.

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Material and methods

The material comprised files of 37 consecutive patients who had undergone surgical-orthodontic treatment at the Department of Oral Diseases of the Turku University Central Hospital, Turku, Finland during the period 2002–2003. An additional inclusion criterion was that all patients had been treated by postgraduate students in orthodontics under the supervision of two experienced orthodontists. Patients with cleft-lip and palate or craniofacial anomalies were excluded. Ethical approval was obtained from the ethics committee of the university hospital.

The files were reviewed and the following information obtained: gender, diagnosis, type of malocclusion (overjet, overbite based on clinical examination), age at the initiation of treatment (usually placement of separating rings), duration of presurgical treatment (until the operation), and duration of postsurgical treatment (from date of operation until date of fixed appliance removal and placement of retainers). In addition, information about extractions (0, 1–2, or 3–4 teeth extracted as part of the orthodontic treatment, excluding 3rd molars), levelling of the lower curve of Spee before or after the operation, and type of operation (bimaxillary, LeFort I as the only operation, bilateral sagittal split osteotomy as the only operation) was retrieved. Three experienced oral and maxillofacial surgeons had performed the operations.

For statistical analyses, two sample *t*-tests, the Kruskal-Wallis and Spearman rank correlation tests were performed using the Statistical Package for Social Science v. 15.01 for Windows (SPSS Inc, Chicago, Ill., USA). A post-research power calculation was made, based on the total treatment time in patients with or without extractions, to study validity of the sample size.

Results

Distribution of patients according to gender showed that 70.3% were females. The most common skeletal diagnosis was mandibular retrognathism with deep bite in 22 patients. Seven patients had mandibular prognathism. The mean (SD) age of the sample was 32.1 (11.0) years (range 17–54 years). Mean (SD) treatment duration was 26.8 (11.2) months, of which presurgical orthodontics took on average 17.5 (9.6) months and postsurgical 9.2 (5.7) months.

Extractions were performed in 16 patients as part of the orthodontic treatment. It was found that patients with extractions had a statistically significantly longer treatment duration than those without extractions (two-sample *t*-test, $p = 0.0376$) (Figure 1). Extraction prolonged treatment duration on average by 8 months in the present sample. When

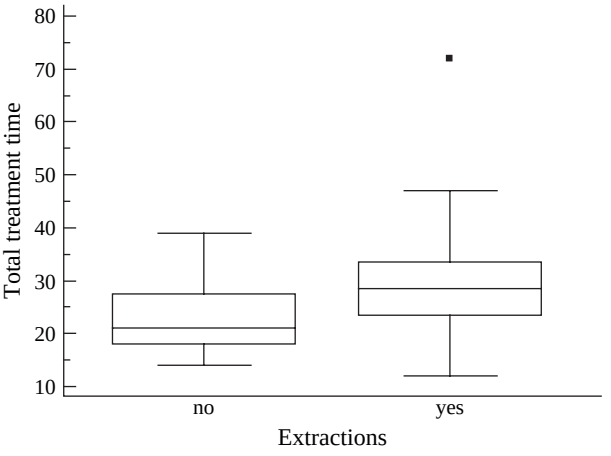

Figure 1. Box plots showing the relationship between tooth extractions (no in 21 and yes in 16 patients) and total treatment time in months.

subjects with different numbers of extracted teeth (0, 1–2, or 3–4) were studied, a statistically significant difference between the groups was found (Kruskal-Wallis test, $p = 0.042$) (Figure 2). According to Spearman rank correlation, no statistically significant relation was found between age of the patients and treatment duration, neither concerning preoperative or postoperative treatment time. Furthermore, none of the other studied variables – overjet, overbite, levelling of the curve of Spee before surgery by intrusion of lower incisors and canines, or extrusion of premolars and molars after surgery – or the type of operation had any statistically significant association with treatment duration.

A post-research power calculation was done based on the total treatment time in patients with or without extractions. It was assumed that duration was normally distributed, variances were equal in both groups, and clinically significant difference in the duration to be 4 months. With these assumptions, 86 subjects would be needed in each group to obtain 90% power.

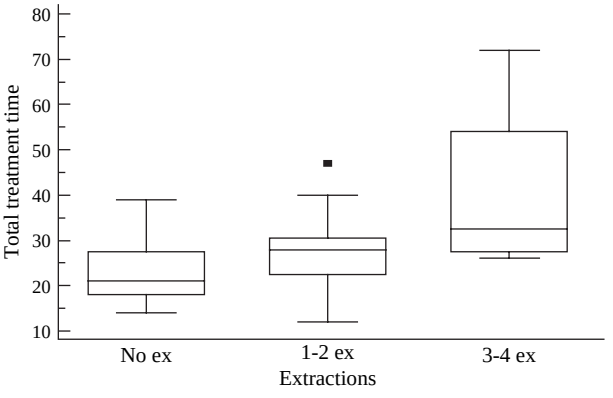

Figure 2. Box plots showing the relationship between number of extracted teeth (0, 1–2, or 3–4) and total treatment time in months.

Discussion

The major limitation of the present study was the small sample size, which has to be kept in mind when interpreting the findings. The retrospective power calculation clearly shows that a considerably larger sample would have increased the power of the study.

The present patient population is a typical surgical-orthodontic patient pool with 70% females and 30% men, and mandibular retrognathism the most common diagnosis [3,5,6]. Mean treatment time was 26.8 months, which compares fairly well with that of previous studies; however, our time is at the upper limit [3,4,7,8]. In the present study, presurgical treatment time was not prolonged by additional waiting time, since access to surgery was possible when needed. Postsurgical orthodontics was found to take an average of 9 months, which has been found to be a critical period in terms of patient acceptance for the postsurgical treatment duration [9]. No detailed information is available on the cooperation of these patients when postsurgical treatment has lasted longer.

Age of the patient was found not to have any statistically or clinically significant impact on treatment time, unlike a common clinical assumption. It has been shown in an experimental study [10] that there is delay only in the initial tooth movement in adult rats compared to growing ones, and that thereafter tooth movement rate is equal. This could be due to faster osteoclast differentiation in young animals [11]. In line with this experimental finding, Robb et al. [12] concluded that there was no difference in the duration of fixed appliance therapy in a group of adults (mean age 31.3 years) compared to younger ones (12.9 years). They found that factors not examined in the present study, such as cancelled appointments and broken appliances, lengthened treatment time. These factors, however, are not age-dependent. Dowling et al. [8] found time spent on orthodontic treatment to be shorter in older age groups than in younger ones. They proposed a reasonable explanation: in older patients, more prosthodontic treatment was performed to finalize occlusion, i.e. meaning limited orthodontic treatment objectives.

The effects of different tooth movement, i.e. extraction versus non-extraction, intrusion before or extrusion after surgery, was another main topic of the study. Extraction treatment was found to lengthen treatment time significantly. This is in line with previous studies [8,13,14], but contrasts with findings by Luther et al. [3,4]. In some studies it has been estimated that extractions make orthodontic treatment duration approximately 4–5 months longer [8,14]. The present findings indicate, on average, an 8-month longer treatment time if extractions are included.

In deep bite cases, two different treatment approaches are available for surgical-orthodontic patients depending on the anterior facial height. If there is no desire to increase facial height (and no need for maxillary surgery), presurgical levelling of excessive curve of Spee by intrusion of the lower incisors and canines is the preferred choice of treatment. On the contrary, in short face patients, presurgical intrusion is not recommended, but instead extrusion of the lower premolars and molars postsurgically. According to Proffit et al. [15], levelling by extrusion after surgery is easier and more efficient than intrusion before surgery. This postulate and our assumption cannot be supported by the present study, since no association was found between presurgical or postsurgical levelling and total treatment time.

Severity of malocclusion assessed by PAR index is reportedly associated with treatment duration only when orthodontics is used for the correction [16]. According to Vig et al. [14], duration of orthodontics is increased on average by 5 months in class II cases with a need for change in the sagittal molar relationship. A comparable conclusion has been drawn by Skidmore et al. [17]. On the other hand, in surgical orthodontic treatment the severity of malocclusion may not be an influential variable on the duration of treatment, since it takes, for example, the same time for a surgeon to advance mandible 6 or 12 mm. The experience of different surgeons is not considered to have any impact on treatment duration, and in any case all three of the present surgeons were experienced with several years of clinical practice.

Inexperience and change of an orthodontist during fixed appliance therapy has been found to contribute significantly to longer treatment time [3,8,18]. In the present study, all orthodontics were made by postgraduate students, and, furthermore, while most cases were treated by one student, the treatment was continued by another one when the first one had completed the 3-year program. Despite this, the mean time of preoperative orthodontics (17.5 months) was the same as reported earlier when specialists had carried out the treatment [3]. Interestingly, it has also been reported that well-qualified orthodontists are associated with longer treatment duration than younger ones, possibly thriving to excellence not yet "seen" by a younger practitioner [19]. Fink & Smith [20] found that detailed finishing was an important source of variation in treatment duration.

The present study and the literature review show that treatment duration in orthognathic surgery may be influenced by several factors and no unanimous opinion exists, particularly concerning the impact of extractions on duration. In our study, the average total treatment time was 26.8 months, and presurgical orthodontics on average 17.5 months. Within the

limitations of the small sample size, the present data indicate that extractions included in the treatment plan are associated with longer duration of orthognathic surgical treatment. On the other hand, age of the patients was found not to be an influential variable. Since as close prediction on treatment duration as possible is important for all parties, more studies with considerably larger patient samples are needed.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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