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A 3-year patient-centred follow-up of 516 consecutively treated orthognathic surgery patients

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SUMMARY The purpose of this study was to evaluate the outcome of a scheme for provision of orthognathic surgery by examining whether patients' expectations were fulfilled as well as their opinions about the result of treatment and side-effects.

Data were obtained during a pre-planned 3-year follow-up clinical examination which included the administration of patient questionnaires. Of 583 subjects (281 females, 235 males; mean age 27.2 years) who underwent surgery during the period 1994–2002, 516 attended (89 per cent). Differences between subgroups and associations between variables were analysed by chi-square or Fisher's exact test.

The most frequent motives for treatment were improvement of dental appearance and chewing ability, indicated by 83 and 81 per cent of the patients, respectively. The expectations were fulfilled for most patients, and satisfaction with the treatment result was reported by 92 per cent. Dissatisfaction was significantly related to gender, skeletal malocclusion, and surgical procedure ($P = 0.001$). Of all patients, 36.8 per cent reported impaired sensory function, the most frequent side effect. Sensory impairment and concern due to disturbed sensation were significantly related to age at surgery ($P = 0.001$ and $P = 0.041$, respectively).

The treatment outcome as perceived by the patients was generally favourable. Even if sensory disturbance was frequently observed, most patients, especially in the younger age groups, seemed to adapt. Certain patient characteristics and surgical procedures were associated with an increased risk of dissatisfaction. These observations are relevant in the guidance of prospective orthognathic patients.

Introduction

Correction of severe skeletal malocclusions usually involves an interdisciplinary team for planning and monitoring of co-ordinated orthodontic and surgical treatment. This elective treatment is demanding to the patient, substantial resources are being spent, and treatment represents risks for unwanted side-effects, such as nerve injuries, resulting in sensory disturbances in the face.

Provision of treatment varies both within and between countries as it is influenced by factors such as organization of health care in general, reimbursement, and access to treatment (Zins *et al.*, 2005). In Norway, treatment is free of charge to the patient provided that the severity of the malocclusion fulfils criteria defined by the National Health Insurance Scheme and that the treatment will be carried out according to a joint plan established by the surgeon and orthodontist. This activity is organized through two university teams for the majority of patients. Over a period of several decades, the team at the University of Oslo has developed protocols in order to systematically review short- and long-term treatment outcomes obtained through this scheme. Reports on the treatment process, skeletal and occlusal changes, and stability after treatment have previously been published (Dowling *et al.*, 1999, 2005; Mobarak *et al.*, 2000a,b, 2001a,b,c; Shaughnessy *et al.*, 2006). A patient-centred approach to examining outcomes of services is an important supplement to the study of morphological and physiological responses to treatment, as success of treatment must also be defined in the context of the patient's perceptions of what was achieved (Phillips, 1999).

Data have the potential to serve as source of information to prospective patients in the consent process. The objective of the present report was, therefore, based on the protocols of the present scheme, to analyse data describing motives, the perceived improvement and side-effects, as well as satisfaction with the treatment result in all patients treated within a 9-year interval.

Subjects

Annually, approximately 130 patients are referred, mainly by orthodontists nation-wide, to the team for evaluation and treatment planning, of whom 60–70 receive surgical treatment. During the consultation, comprehensive information is provided and when surgery is indicated, the patients are offered treatment. A report is sent to the referring orthodontist, and the final decision to start treatment is made in agreement between the patient and orthodontist.

Planning of dental and skeletal movements is carried out by the team using the Dentofacial Planner computer program (Dentofacial Software, Toronto, Ontario, Canada), and the pre- and post-surgical orthodontic treatments are performed

by the local orthodontist. Patients, undergoing surgery at Ullevaal University Hospital, Oslo, have, for the last three decades, been included in a 3-year follow-up regimen at the Department of Orthodontics, University of Oslo. Since 1990 rigid fixation has been used as a standard procedure for stabilizing the bony segments. The present study comprises patients who underwent surgery in the period between January 1994 and January 2003, as the protocol for collecting patient information was revised in 1994. Of the 583 patients undergoing surgery during this period, 516 (281 females, 235 males) were included in the study. Eleven were excluded because they had a diagnosis of craniofacial syndrome, cleft lip and palate, or major trauma, and 56 did not attend the follow-up. The mean age at surgery was 27.2 years (SD 10.3, range 12.6–72.4 years).

Methods

According to the present protocol, the patients were clinically and radiographically examined pre-treatment, pre-operatively, and at five different occasions post-operatively. Pre-treatment malocclusion was categorized as skeletal Class I, II, III. At the final follow-up session, 3 years after surgery, the patients were, while attending the clinic, also asked to fill in a questionnaire addressing their attitudes to the initial anomaly, the treatment, and the treatment outcome (Table 1). In addition to responding to questions with fixed alternative answers, the patients were invited to give free comments. Additionally, clinical information relevant to the responses to the questions concerning neurosensory function was collected by mapping out the affected area (Høgevold *et al.*, 2001) and by two-point discrimination test using a pair of dividers. Patients reporting symptoms related to the temporomandibular joint (TMJ) were examined for signs of dysfunction.

For statistical analyses of the data, the Statistical Package for Social Sciences for Windows (SPSS Inc., Chicago, Illinois, USA) was used. Differences between subgroups and association between variables were analysed by chi-square or Fisher's exact tests.

Table 1 Questions 1–7 from the questionnaire distributed at the 3-year follow-up examination of 516 consecutively surgically treated patients. Response alternatives in italics.

Q1: What was the reason for your decision to start treatment?
Not important at all/Not important/Somewhat important/Very important
a: Improve dental appearance
b: Improve facial appearance
c: Improve chewing ability
d: Improve speech
e: Prevent future problems related to teeth and jaws
f: Other reasons (free text)

Q2: How would you describe the result of treatment?
Great improvement/Some improvement/No improvement/Worse
a: Dental appearance
b: Facial appearance
c: Chewing ability
d: Speech
e: Other (free text)

Q3: Has the treatment had any positive impact on your social life?
No impact/Some impact/Great impact/Not sure
a: Among family and friends
b: Among colleagues

Q4: With your current experience, would you have had this treatment?
Yes, definitely/Yes, probably/No, probably not/No, definitely not/Don't know

Q5: a: Are you satisfied with the result of treatment?
Very satisfied/Satisfied/Somewhat dissatisfied/Very dissatisfied
b: If you are dissatisfied, what is the reason? (free text)

Q6: How would you describe the sensation in the face/lip/gums at present?
Normal, almost normal/Somewhat reduced/Markedly reduced/Increased/Complete loss of sensation/Pain

Q7: Is the impaired sensation of concern to you because it affects your daily life?
Mild/Moderate/Marked/Not relevant (normal sensation)

Results

The most frequent skeletal malocclusion was Class III which appeared most often in males. A skeletal Class II malocclusion was most frequent among females (Table 2). The majority of patients had mandibular surgery only (64.3 per cent). The distribution of females and males in various surgical categories is presented in Table 3.

Table 2 Distribution of skeletal malocclusion among 516 consecutively surgically treated patients.

	Females		Males	
	n	%	*n*	%
Skeletal Class I (*n* = 77)	45	16.0	32	13.6
Skeletal Class II (*n* = 154)	101	35.9	53	22.6
Skeletal Class III (*n* = 285)	135	48.0	150	63.8
Total	281	100.0	235	100.0

Chi-square 13.96; 2 df; $P = 0.001$.

Motives

The patients' motives and concerns that initiated treatment are presented in Figure 1. Improvement of dental appearance and chewing ability appeared to be the most important factors for requesting treatment, and more than 80 per cent indicated that this was important or very important. Nineteen patients answered, in an open-ended question, that problems related to the TMJ were the reason for undergoing treatment. No statistically significant differences (1 per cent level) between genders or categories of skeletal malocclusion were observed.

Perceived improvement

The majority of the patients considered the result of treatment to represent a great improvement in both dental

Table 3 Distribution of surgical procedures among 516 consecutively surgically treated patients.

	Females		Males	
	n	%	*n*	%
Mandibular setback (*n* = 180)	91	32.4	89	37.9
Mandibular setback and Le Fort I (*n* = 76)	29	10.3	47	20.0
Mandibular advancement (*n* = 104)	65	23.1	39	16.6
Mandibular advancement and Le Fort I (*n* = 24)	15	5.3	9	3.8
Maxillary surgery (Le Fort I; *n* = 78)	49	17.4	29	12.3
Other procedures (*n* = 54)	32	11.4	22	9.4
Total	281	100.0	235	100.0

Chi-square 15.29; 5 df; $P = 0.009$.

and facial appearance and chewing ability (Figure 1b). Males gave a more favourable response to the impact of treatment on dental appearance compared with females (87 per cent males versus 76 per cent females responded 'great improvement'; $P = 0.01$). When perceived improvement was related to category of skeletal malocclusion, the greatest improvement was reported by individuals being treated for a skeletal Class III malocclusion, both regarding dental (87 versus 70 per cent in Class II) and facial appearance (62 versus 42 per cent in Class II); $P < 0.001$. Patients with a skeletal Class II malocclusion reported more frequently that treatment had no effect on chewing ability (25 versus 13 and 14 per cent in Class I and III, respectively; $P = 0.002$).

When the perceived result was analysed separately for subgroups based on the individuals' motives, it appeared that 70 per cent or more of those reporting appearance (dental and facial) and chewing as motives considered these dimensions to be greatly improved (Figure 2). Thus, the expectations appeared to be fulfilled for most patients. Of the 19 subjects reporting TMJ problems as an important motivating factor, four indicated that they still had problems at the 3-year follow-up. The responses to the question concerning whether the treatment had a positive effect on social relationships (Q3, Table 1) varied, with approximately 20 per cent of the respondents answering that treatment had had a great impact both in the relationship with family/friends and colleagues whereas 44 and 43 per cent, respectively, indicated no such effects. Males more frequently reported a positive effect on the relationship with family/friends ($P = 0.027$).

Satisfaction with the treatment result

The distribution of responses to the question about whether the patients would have re-elected surgery based on their present experience is shown in Table 4. Among skeletal Class II patients, 14 per cent stated that they would not have

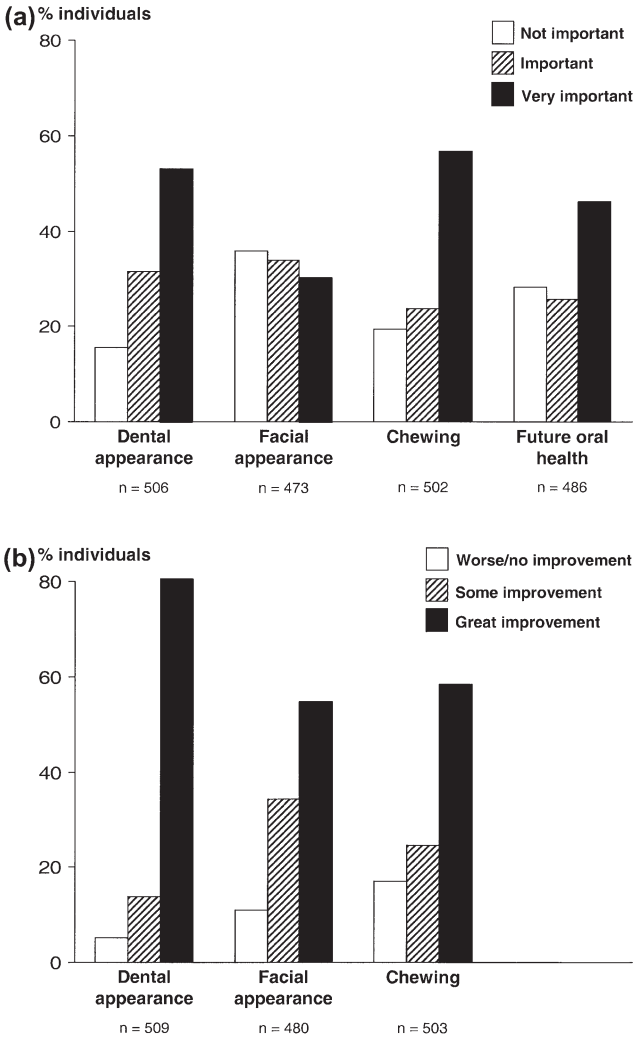

Figure 1 Relative distribution of responses to questions concerning motives for treatment (Q1, Table 1, the alternatives 'Not important at all' and 'Not important' are combined) (a) and (b) about the treatment result (Q2, Table 1) among 516 consecutively surgically treated patients.

made the same decision again, whereas only 4 per cent of the Class III patients selected this response ($P < 0.001$). The majority (92 per cent) of the patients were satisfied with the treatment result. Relatively more females than males expressed dissatisfaction ($P < 0.001$; Table 5). Among the dissatisfied, 51 per cent stated that they would have made the same decision.

The distribution of responses related to age, category of skeletal malocclusion, and surgical procedure are presented in Tables 6, 7, and 8, respectively. No statistically significant differences were found between the age groups (Table 6). Dissatisfaction was most frequently reported among patients with a skeletal Class II malocclusion pre-treatment (Table 7). A significant association between dissatisfaction and surgical procedures was observed ($P < 0.001$; Table 8). Dissatisfaction was most frequently reported after advancement of the mandible, both when performed as the only procedure or in combination with other osteotomies.

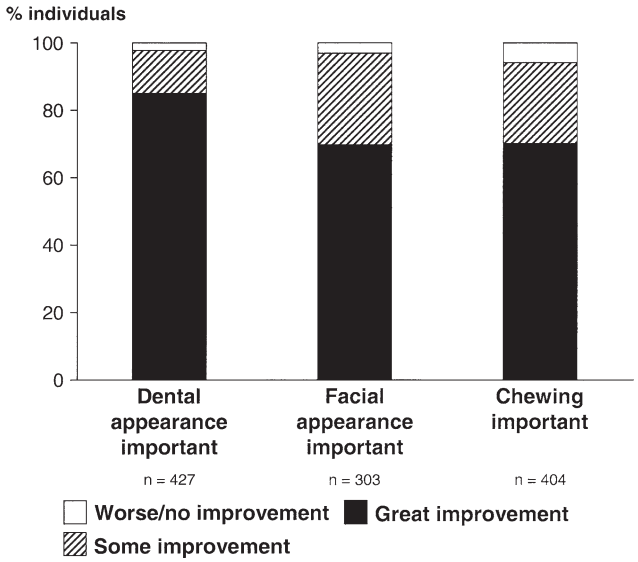

Figure 2 Relative distribution of responses to questions concerning the treatment result (Q2 Table 1) among patients who answered 'Important' and 'Very important' to the questions about motives (Q1, Table 1).

Table 4 Distribution of answers (per cent) to question about whether the individuals would have re-elected surgery based on their present experience (Q4, Table 1) among the 516 consecutively surgically treated patients.

	Yes, definitely	Yes, probably	No, probably not	No, definitely not	Don't know
Females (n=281)	67.3	18.1	3.9	3.2	7.5
Males (n=235)	77.9	14.0	3.4	2.1	2.6
Total (n=516)	72.1	16.3	3.7	2.7	5.2

Significant difference between genders: chi-square 9.88; 4 df; $P = 0.042$.

Table 5 Distribution of answers (per cent) to the question concerning satisfaction with treatment result (Q5, Table 1) among the 516 consecutively surgically treated patients.

	Very satisfied	Satisfied	Somewhat dissatisfied	Very dissatisfied
Females (n=281)	55.5	32.4	10.0	2.1
Males (n=235)	68.9	27.2	3.4	0.4
Total (n=516)	61.6	30.0	7.0	1.4

Significant difference between genders: Chi-square 15.37; 2 df; $P < 0.001$.

The response alternative 'very satisfied' was selected by more than 70 per cent of those who had mandibular setback (both as the only procedure and in combination with maxillary surgery), whereas only one-third of those having mandibular advancement in combination with maxillary surgery selected this alternative.

Table 6 Relationship between response to the question about satisfaction with the treatment result (Q5, Table 1, responses dichotomized) and age at surgery among the 516 consecutively surgically treated patients.

	Satisfied %	Dissatisfied %
<20 years (n=156)	94.2	5.8
20–29 years (n=205)	91.7	8.3
30–39 years (n=88)	92.0	8.0
≥40 years (n=67)	85.1	14.9
Total (n=516)	91.7	8.3

No significant difference between age groups. Chi-square 5.17; 3 df; $P = 0.160$.

Table 7 Relationship between response to the question concerning satisfaction with the treatment result (Q5, Table 1, responses dichotomized) and category of skeletal malocclusion among the 516 consecutively treated patients.

	Satisfied %	Dissatisfied %
Skeletal Class I (n=77)	93.4	6.5
Skeletal Class II (n=154)	83.1	16.9
Skeletal Class III (n=285)	95.8	4.2
Total (n=516)	91.7	8.3

Significant difference between categories of skeletal malocclusion: chi-square 21.42; 2 df; $P < 0.001$.

Table 8 Relationship between response to the question concerning satisfaction with the treatment result (Q5, Table 1, responses dichotomized) and category of surgical procedure among 516 consecutively surgically treated patients. Percentage in parenthesis.

	Satisfied %		Dissatisfied %	
Mandibular setback (n=180)	175	(97.2)	5	(2.8)
Mandibular setback and Le Fort I (n=76)	73	(96.1)	3	(3.9)
Mandibular advancement (n=104)	87	(83.7)	17	(16.3)
Mandibular advancement and Le Fort I (n=24)	19	(79.2)	5	(20.8)
Maxillary surgery (Le Fort I; n=78)	70	(89.7)	8	(10.3)
Other procedures (n=54)	49	(90.7)	5	(9.3)

Significant difference between surgical procedures: chi-square 23.28; 5 df; $P < 0.001$.

The patients' stated reasons for dissatisfaction (Q5, Table 1) were allocated to the following categories: impaired nerve function (n = 11), relapse (n = 11), appearance (n = 8), TMJ problems (n = 8), and other reasons (n = 9). Four patients indicated more than one reason.

Sensory function

Of all the patients, 63.2 per cent reported that their sensory function had not been affected by treatment. Sensory function was reported to be 'normal' or 'almost normal' by 92.2 per cent of the 77 patients having had mandibular setback by extraoral vertical ramus osteotomy, whereas the corresponding figure for the 207 patients with a sagittal split osteotomy as the only surgical procedure was 48.8 per cent.

A total of 316 patients had a sagittal split osteotomy as the only procedure or in combination with other osteotomies. Of these only a few indicated that the impaired sensation was of concern to them because it affected their daily life (mild = 16.2 per cent, moderate = 4.1 per cent, severe = 1.6 per cent). The age at the time of surgery was significantly associated with disturbed sensory function as reported by the patient (P = 0.001; Figure 3). Concern about impaired sensation and dissatisfaction with the treatment result among those with impairment are shown in Figure 4. Concern due to impairment increased significantly with age (P = 0.041).

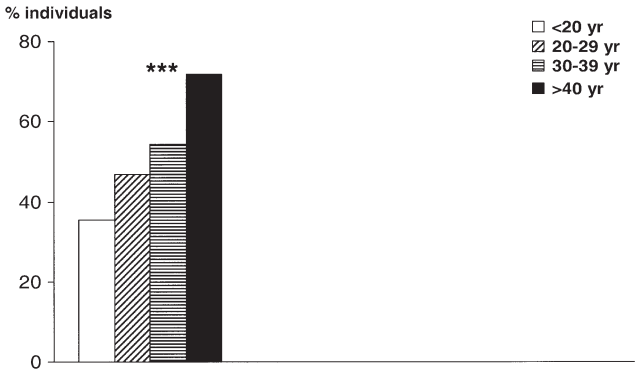

Figure 3 Individuals having had a sagittal split osteotomy (n = 316) among 516 consecutively surgically treated patients: Relative frequency of individuals reporting impaired sensory function according to age. Chi-square 15.94; 3 df; P = 0.001 (***).

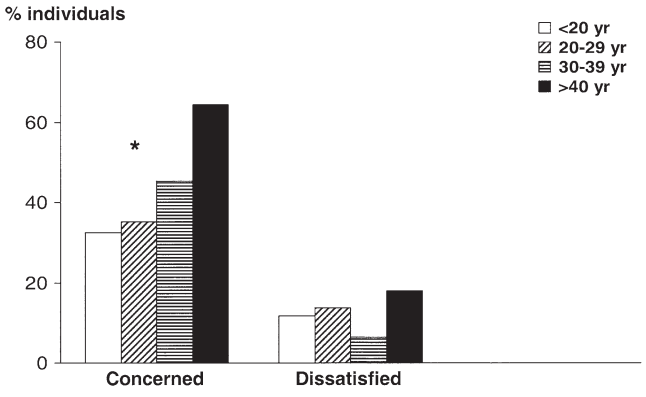

Figure 4 Individuals having had a sagittal split osteotomy who reported impaired sensory function (n = 151) among the 316 consecutively surgically treated subjects: Relative frequency of individuals reporting concern according to age. Concerned: Chi-square 8.25; 3 df; P = 0.041(*).

Discussion

Reports on orthognathic care may represent outcomes of activities in the community or in academic centres (Phillips, 1999). The results from the present study may be considered to be representative for national care in the sense that the scheme presented comprises the vast majority of patients and involves orthodontists from all over the country. Reports of the overall outcome of schemes for orthognathic care are rare in the literature. The present study is an attempt to provide a general picture of the outcome of care as perceived by the patient, which in turn may stimulate revision of protocols and guidance of patients seeking care.

Patients requiring orthognathic surgery constitute approximately 1 per cent of orthodontic subjects in Norway. Centralized services are therefore important to obtain a critical mass for maintaining surgical competence, performing systematic analyses of treatment outcomes, and reviewing treatment approaches. Data collected on the morphological and physiological outcomes has resulted in a change in the approach to mandibular surgery. In 1990–1995 sagittal split osteotomies constituted 87 per cent of mandibular setback procedures; the decrease to 57 per cent in 1996–2002 was a result of analysis of these data (Mobarak *et al.*, 2000b; Høgevold *et al.*, 2001). The current indications for extraoral subcondylar ramus osteotomy, with plate fixation as an alternative to the sagittal split osteotomy, are a morphologic pattern allowing a straight and moderately large setback of the mandible together with a resolute wish of the patient to maintain the neurosensory function. Aggregation of data on patients' perceptions of treatment has similarly the potential to stimulate adjustment of approaches.

The low dropout rate in the present study, which also contributes to the representativeness of the findings, may be due to the regular post-operative follow-up examinations. Furthermore, the presence of a clinical assistant not involved in the treatment to guide the patients during the sessions probably reduced biased responses due to misinterpretation. It should, however, be borne in mind that description of motives was anamnestic (Q1, Table 1). Additionally, cognitive dissonance might operate for some of the questions (e.g. Q2, Q4, and Q5, Table 1).

Dental appearance was a frequent motive for requesting treatment (Figure 1a), and this is in accordance with other studies (Phillips *et al.*, 1997; Zhou *et al.*, 2001). The percentage of patients wanting improvement of facial appearance and chewing function varies considerably in reports from different countries (Athanasiou *et al.*, 1989; Garvill *et al.*, 1992; Phillips *et al.*, 1997; Nurminen *et al.*, 1999; Rivera *et al.*, 2000; Zhou *et al.*, 2001; Williams *et al.*, 2005). In the present study, it was considered important to relate the self-perceived treatment effect to the stated motive as a measure of whether the patient's expectations had been fulfilled (Figure 2). It has been observed that patients who had realistic expectations are more satisfied in the long term (Chen *et al.*, 2002). It is therefore crucial that

professionals understand patients' motives for and expectations to treatment (Nurminen *et al.*, 1999).

The overall rate of patients expressing satisfaction with the treatment result (92 per cent, Table 5) is comparable with findings reported in a literature review by Cheng *et al.* (1998). In 11 of the 13 studies included, overall satisfaction rates were more than 90 per cent. Patient satisfaction is a multifaceted dimension as individuals may have a complex set of important and relevant beliefs which cannot be embodied in terms of expressions of satisfaction (Williams, 1994). It has been suggested that health-related quality of life (HRQoL) assessments should be applied to orthognathic patients (Bennett and Phillips, 1999; Cunningham and Hunt, 2001). Such assessments are comprehensive and therefore time consuming and place great demands on patients. HRQoL assessments have previously been applied to samples of orthognathic patients (Hatch *et al.*, 1998; Cunningham *et al.*, 2002; Motegi *et al.*, 2003). The methods used in the present study are according to methodological recommendations when reliable, generalizable results are desired (Phillips, 1999).

It has previously been reported that older patients are more satisfied after orthognathic treatment compared with younger patients (Scott *et al.*, 2000). The present data did not show any age differences (Table 6). Even if the older patients in this study had sensory impairment more often which caused them greater concern compared with younger individuals, the rate of dissatisfied patients did not differ significantly across the age groups among those with disturbed sensation. In a Swedish study (Westermark *et al.*, 1999), however, a tendency was observed for impaired sensitivity to influence ratings of dissatisfaction in older patients.

The highest rate of dissatisfied individuals was observed among those having had mandibular advancement surgery, either as the only procedure or in combination with maxillary surgery (Table 8).

As dissatisfaction was reported significantly more frequently by females than males (Table 5), this might be due to the overrepresentation of females in these subgroups (Table 3) or may be related to morphology, the surgical intervention, relapse, or a combination of factors. Previous investigations have shown that patients with specific skeletal morphological patterns may be more prone to relapse after mandibular advancement surgery (Mobarak *et al.*, 2001b; Borstlap *et al.*, 2004). Future studies should focus on the association between morphology and patients' perceptions.

As orthognathic surgery is associated with improvement in psychosocial adjustment, it has been claimed that patients should generally be offered treatment to correct a subjectively perceived disfigurement (Lazaridou-Terzoudi *et al.*, 2003). Certain patient characteristics and surgical procedures may increase the risk for patient dissatisfaction. Even if patients belonging to high-risk groups should not be denied treatment, protocols for comprehensive information and communication that take these factors into account should be routinely applied.

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