Surgical correction of mandibular prognathism in Norway, 1975–1984

A national survey

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The estimated need for surgical correction of mandibular prognathism in Norway is 500 patients underwent surgical correction of mandibular prognathism; that is, only 117 patients orthognathic surgery in Norway showed that in the decade from 1975 to 1985 altogether 1169 patients underwent surgical correction of mandibular prognathism; that is, only 117 patients were treated yearly. Extraoral vertical subcondylar osteotomy of the mandibular ramus was the preferred surgical technique, performed on 57% of the patients. Intraoral vertical subcondylar osteotomy of the ramus increased in use and thus seems to be taking over for the extraoral technique. Sagittal split osteotomy was used on 25% of the patients. The different units showed great variation in their preference for the different surgical techniques. Preoperative orthodontics was widely used, on a mean of 77% of the patients. The average hospital stay was 8.5 days, somewhat longer than reported from other countries; however, geographical conditions should be taken into consideration. □ *Maxillofacial surgery; sagittal split osteotomy; subcondylar osteotomy*

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Surgical correction of mandibular prognathism is a well-accepted and documented procedure in maxillofacial surgery. Since the first case was presented by Hullihen (1) in 1846, many reports have been published on various surgical methods and on the results of the treatment. The surgical techniques have been continually redesigned and refined. Within the past three decades particularly extraoral vertical subcondylar osteotomy of the mandibular ramus (2–7), intraoral vertical subcondylar osteotomy of the mandibular ramus (8–11), and sagittal split osteotomy (12–14) have been widely used. Severe mandibular prognathism requiring orthognathic surgery in conjunction with orthodontic treatment is estimated to affect more than 340,000 young people aged 12–17 years in the United States (15). Transferring these numbers to conditions prevailing in Norway, about 5600 adolescents in this age group with mandibular prognathism will need surgery—that is, about 900 orthognathic operations for this anomaly every year.

In Norway the first surgical correction of mandibular prognathism was performed in 1932 (16), and Wang-Norderud (17, 18) reported that more than 400 prognathic patients had been operated on from 1940 to 1952 at Ullevål Hospital in Oslo. This hospital was the only one performing this type of operation up to 1967; later, different maxillofacial units started orthognathic surgery.

However, there are no surveys indicating the number of patients operated on for mandibular prognathism in Norway, the surgical techniques in use, and the morbidity of such operations. To elucidate these facts and the extent of preoperative orthodontics in use, a nationwide study of the surgical correction of mandibular prognathism in Norway for 1975–1984 was initiated.

Methods and materials

Questionnaires were sent to the oral and maxillofacial surgery units performing orthognathic surgery in Norway. These—a

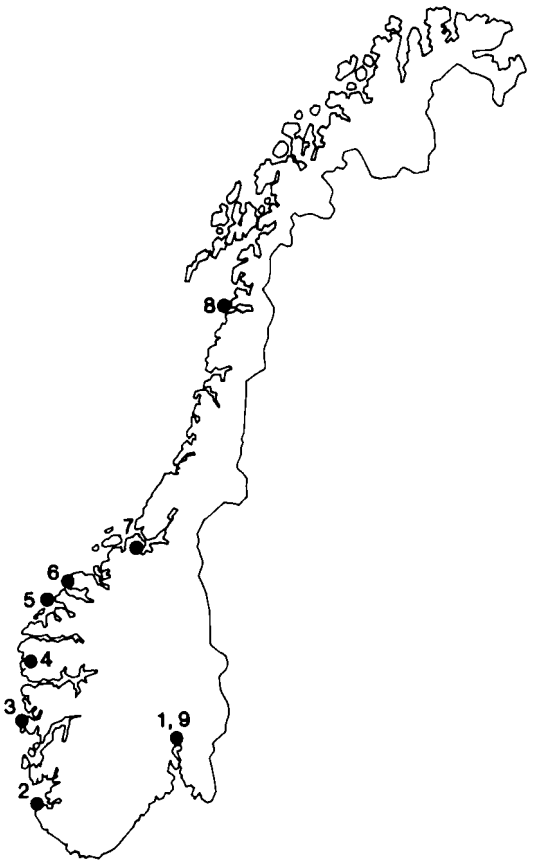

Fig. 1. Maxillofacial and oral surgery units performing orthognathic surgery in Norway. 1 = Regional Hospital Ullevål, Oslo; 2 = District Hospital in Rogaland, Stavanger; 3 = Regional Hospital Haukeland, Bergen; 4 = District Hospital in Sogn and Fjordane, Førde; 5 = District Hospital in Møre and Romsdal, Ålesund; 6 = Local Hospital in Molde; 7 = Regional Hospital in Trondheim; 8 = District Hospital in Nordland, Bodø; and 9 = Clinic of Oral Surgery and Oral Medicine, University of Oslo, Dental School, Oslo (these are the names used in the tables).

total of nine departments (Fig. 1)—responded to the following questions:

1. The number, age, and sex of the patients operated on for mandibular prognathism yearly during the 10-year period 1 January 1975 to 31 December 1984.

2. The techniques in use (Fig. 2): a) extraoral, vertical subcondylar ramus osteotomy (EVSO); b) intraoral, vertical subcondylar ramus osteotomy (IVSO); c) sagittal split osteotomy (SSO); d) corpus osteotomy (CO); e) other techniques (such as segment osteotomy, horizontal ramus osteotomy); and f) combinations of two or more of these techniques.

3. Information concerning the use of preoperative orthodontics.

4. The number of days in the hospital (hospital period).

5. The duration of intermaxillary fixation in weeks.

Patients only undergoing genioplasty were excluded from the study, because this operation did not alter the intermaxillary relationship of the prognathic mandible and the midface skeleton. Data about preoperative orthodontics and the duration were not available from the District Hospital in Nordland. The answers to the questionnaires were evaluated by two-way frequency analysis.

Results

Altogether 1169 patients were surgically treated for mandibular prognathism during the decade 1975 to 1985. The distribution of these patients in each year is shown in Table 1 and Fig. 3. Some hospitals started orthognathic surgery during this period: the District Hospital in Rogaland in 1978, the District Hospital in Sogn and Fjordane in 1980, the Local Hospital in Molde in 1980, and The Clinic of Oral Surgery and Oral Medicine, University of Oslo, in 1978. The District Hospital in Nordland did not have maxillofacial services in 1984. The increased number of patients after 1980 is mostly due to the activity in these new departments. The number of operated cases has been stable in the other units, except for a minor increase at the Regional Hospital in Trondheim.

Mean patient age at the time of operation in this material was 23.6 years, ranging from 14 to 68 years. The percentage distribution is shown in Table 2. The majority of these patients were between 15 and 25 years old. The hospitals in Bodø and Ålesund appeared to treat the youngest patients, while the Clinic of Oral Surgery and Oral Medicine in Oslo had a majority of patients over the age of 30 years. The largest age group at the other hospitals was 20–24 years.

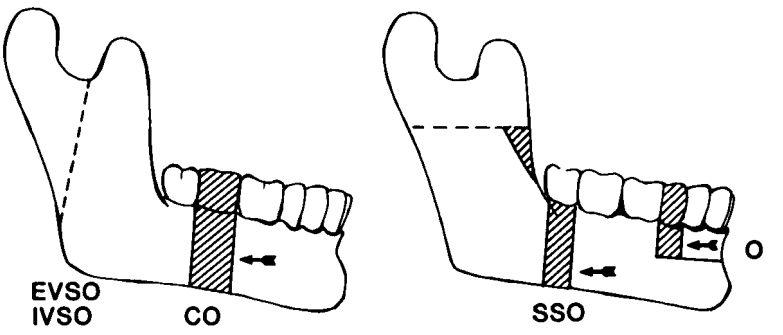

Fig. 2. Surgical techniques to reduce mandibular prognathism. Osteotomy lines. Extraoral (EVSO) and intraoral (IVSO) vertical subcondylar ramus osteotomy, corpus osteotomy (CO), sagittal split osteotomy (SSO), segment osteotomy (O = other).

Table 1. Norwegian patients operated on for mandibular prognathism in nine oral surgery units 1975–1984

Surgical unit	Year of operation										Total
	75	76	77	78	79	80	81	82	83	84	
Oslo	35	32	31	45	37	31	28	35	38	42	354
Stavanger	0	0	0	1	4	4	5	4	8	5	31
Bergen	23	18	19	19	25	27	24	23	28	38	244
Førde	0	0	0	0	0	1	2	2	2	2	9
Ålesund	18	12	16	17	17	19	16	3	15	22	155
Molde	0	0	0	0	0	5	8	7	10	11	41
Trondheim	2	6	7	6	9	8	7	11	13	13	82
Bodø	22	29	28	17	9	31	24	18	17	0	195
Dental School, Oslo	0	0	0	2	0	4	9	11	21	11	58
Total	100	97	101	107	101	130	123	114	152	144	1169

Out of a total of 1166 patients, 664 (56.9%) were females and 502 (43.1%) were males. The females were treated at a lower age than the males (Table 3).

The operative techniques used in the different hospitals are shown in Table 4. EVSO was the method most widely used, performed on 58% of the patients, followed by SSO (23%) and IVSO (8%). In Bodø the SSO technique was the only technique used, whereas EVSO was the technique used almost exclusively in Stavanger, Førde, Molde, and Trondheim. The CO was mainly performed at Ullevål. Fig. 4 shows the changing trends of the operative techniques. The IVSO appeared to replace the EVSO, and combinations of the different methods increased in number.

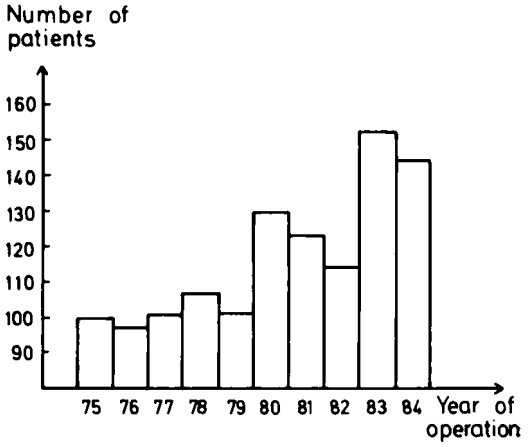

Fig. 3. Norwegian patients operated on for mandibular prognathism during 1975–1984 (n = 1169).

No association was observed as to age, sex, and surgical method used. However, such dependence appeared related to the operating department and the year of treatment.

On an average, 77.3% of the patients had preoperative orthodontic treatment (Table 5); however, there was a marked variation in the use of preoperative orthodontics. In Ålesund more than half the patients (56.5%)

Table 2. Percentage age distribution of Norwegian patients (n = 1166) operated on for mandibular prognathism at 9 oral surgery units 1975–1984

Surgical unit	Age groups, years								Total
	15–19	20–24	25–29	30–34	35–39	40–49	50–59	60–	
Oslo	22.9	35.9	18.4	12.7	5.9	3.4	0.8	0.0	100.0
Stavanger	9.7	41.9	19.4	22.6	3.2	0.0	3.2	0.0	100.0
Bergen	28.3	39.3	14.8	4.5	6.6	4.5	0.8	1.2	100.0
Førde	0.0	55.6	11.1	11.1	11.1	0.0	11.1	0.0	100.0
Ålesund	32.9	13.5	18.1	18.1	9.7	5.2	2.6	0.0	100.0
Molde	29.3	31.7	17.1	7.3	7.3	4.9	2.4	0.0	100.0
Trondheim	13.9	45.6	15.2	11.4	6.3	5.1	2.5	0.0	100.0
Bodø	31.3	20.0	19.0	12.8	9.7	5.1	2.1	0.0	100.0
Dental School, Oslo	5.2	19.0	20.7	13.8	15.5	12.1	12.1	1.7	100.0
Total	25.0	31.0	17.5	11.7	7.7	4.6	2.1	0.4	100.0

Table 3. Sex distribution related to age groups of Norwegian patients (n = 1166*) operated on for mandibular prognathism 1975–1984

Sex	Age groups, years								Total
	15–19	20–24	25–29	30–34	35–39	40–49	50–59	>60	
Females	200 (30.1)†	168 (25.3)	102 (15.3)	83 (12.5)	64 (9.6)	29 (4.4)	15 (2.3)	3 (0.5)	664 (100)
Males	91 (18.1)	193 (38.4)	102 (20.3)	54 (10.8)	26 (5.2)	25 (5.0)	10 (2.0)	1 (0.2)	502 (100)
Total	291 (25.0)	361 (31.0)	204 (17.5)	137 (11.7)	90 (7.7)	54 (4.6)	25 (2.1)	4 (0.4)	1166 (100)

* Data were missing on three patients.
† Numbers in parentheses give the percentage.

Table 4. The surgical techniques used at 9 Norwegian oral surgery units 1975–1984

Surgical unit	Surgical techniques						Total
	EVSO	IVSO	SSO	CO	Other	Combinations	
Oslo	214	0	59	70	0	11	354
Stavanger	31	0	0	0	0	0	31
Bergen	201	32	0	0	6	5	244
Førde	9	0	0	0	0	0	9
Ålesund	106	38	5	4	0	2	155
Molde	40	0	0	0	0	1	41
Trondheim	79	0	2	0	1	0	82
Bodø	0	0	195	0	0	0	195
Dental School, Oslo	3	21	7	2	10	15	58
Total	683	91	268	76	17	34	1169

did not get this treatment; in Stavanger, however, 1 out of the total of 30 patients did not receive any preoperative orthodontics.

The present analysis did not indicate any dependence between preoperative orthodontics and the surgical technique used. However, as predicted, there was a direct correlation between patient age and preoperative orthodontics (Fig. 5).

The average hospital stay for all patients was 8.5 days. However, marked variations were found between the different units (Table 5). As expected, the operative technique influenced the hospital stay. The SSO

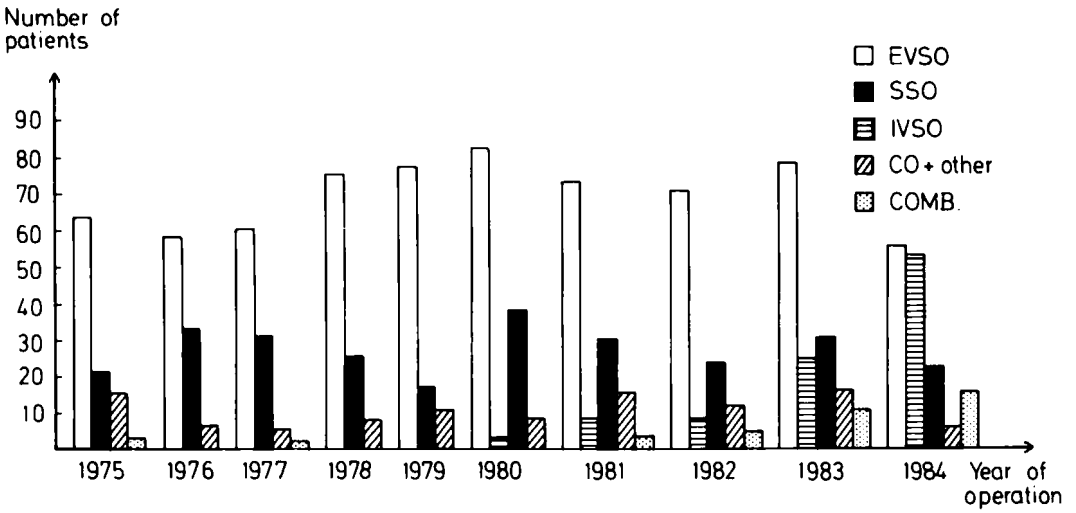

Fig. 4. The surgical techniques used on 1169 Norwegian patients operated on for mandibular prognathism during 1975–1984.

and the CO had a mean hospital stay of 13.0 days, and the IVSO only 5.1 days. The patients' age and preoperative orthodontics made no significant difference in the hospital stay.

The period of intermaxillary fixation ranged from 0 to 21 weeks, with a mean of 6.9 weeks. The departments demonstrated significant differences (Table 5). As expected, the choice of surgical techniques influenced the duration of this period. Thus the SSO required a mean of 7.8 weeks of intermaxillary fixation; the CO, 7.5 weeks; the IVSO and EVSO techniques, 6.6 weeks; while the group 'other' showed a mean of only 2.7 weeks.

Discussion

Nordenram & Waller (6) stated that mandibular protrusion is the commonest jaw deformity in Scandinavia. However, it is difficult to find documented support for this statement; as a matter of fact, mandibular deficiency appears to be commoner (15, 19).

Table 5. Hospital stay, period of intermaxillary fixation, and preoperative orthodontics of 1169 patients operated on for mandibular prognathism at 9 oral surgery units 1975–1984

Surgical unit	Mean hospital stay (days)	Mean intermaxillary fixation period (weeks)	Preoperative orthodontic treatment (no. of patients and %)
Oslo	11.6	7.9	298 (84.2)
Stavanger	3.0	6.0	30 (96.8)
Bergen	4.9	5.9	218 (89.3)
Førde	3.3	6.4	7 (77.8)
Ålesund	5.3	6.4	67 (43.5)
Molde	6.0	6.6	36 (87.8)
Trondheim	8.4	8.0	62 (75.6)
Bodø	12.8	—	— (—)
Dental School, Oslo	4.0	6.5	34 (58.4)
Total	8.5	6.9	752 (77.3)*

* Of the 973 patients for whom information was available, 752 had received preoperative orthodontics.

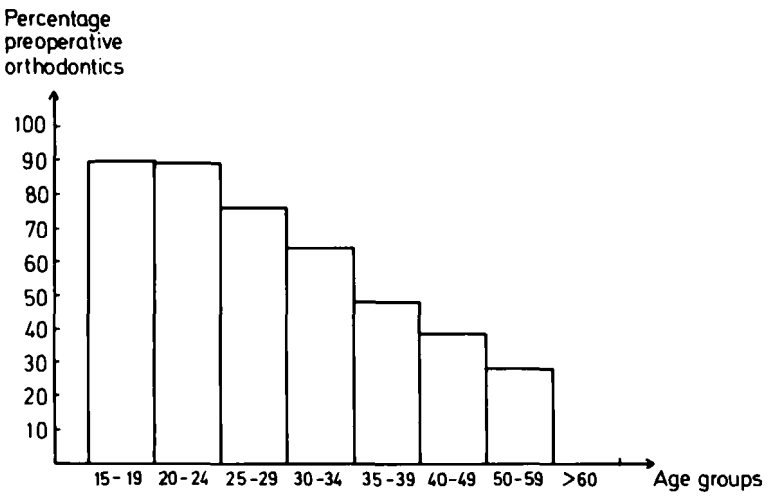

Fig. 5. Percentage preoperative orthodontics related to the various age groups in 973 Norwegian patients operated on for mandibular prognathism during 1975–1984.

Scandinavian prevalence studies of malocclusion (19–23) report 1–7% mesial occlusion (Angle class 3) and less than 1% with frontal mandibular overjet (20, 23). Jonsgar (23) found only 0.64% of the boys and 0.22% of the girls with mandibular overjet in a study of Norwegian children 11 years of age. Mandibular prognathism increases to some extent from childhood to adolescence (24, 25), but it is important to recall that Angle class 3 and mandibular prognathism are not equivalent terms. Nevertheless, it seems reasonable to accept that not more than 1% of the population need surgical correction. With 50,000 live births each year in Norway, possibly 500 people will have a mandibular prognathism that may require surgery. The calculations presented by Bell et al. (15), mentioned in the introduction, thus appear to be an overestimation and not transferable to the Norwegian population.

The present study indicates that the mean of 117 patients treated each year in the past decade only represents 25% of a national estimated requirement. However, there was an increase in the last years of the period. A cumulated need for surgical treatment should also be expected. In 1986 Nordenram & Hjørting-Hansen (26) indicated that about 300 patients with mandibular prognathism are surgically treated each year in Denmark, Finland, Norway, and Sweden. Norway has less than one fifth of the population of these countries, and 117 patients are operated on each year. It seems unlikely that the other countries are performing relatively fewer such operations than Norway, and it is possible that the number 300 is an underestimation (26).

The age and sex distribution of the patients treated in Norway is close to that observed in other countries (7, 27, 28).

In 1981 Jönsson et al. (29) stated that extraoral oblique (vertical) sliding osteotomy and sagittal osteotomy nowadays are the commonest procedures for surgical correction of mandibular prognathism, whereas Bell et al. (15) in 1980 stated that 'in most instances . . . intraoral techniques are preferred to the older extraoral techniques'. In a survey of the United States (11) in 1985 18% of the oral and maxillofacial surgery departments preferred the EVSO, 61% the IVSO, and 15% the SSO technique for correction of mandibular prognathism. This Norwegian study shows that in the decade 1975–85 EVSO was the treatment of choice for 58% of the patients. IVSO was preferred in only 8% of the cases but was equal to EVSO in 1984 and seems now to be the treatment of choice for most of the patients. The SSO technique was stable at about 25%, mostly performed in Bodø. Corpus osteotomy was developed at Ullevål Hospital (18, 30) and is still in use at this unit. Generally, the preferred surgical methods are

dependent on the surgeon, with little variations in their surgical technique. Exceptions from this trend are the units of Ullevål, Haukeland, Ålesund, and the Dental School in Oslo.

Combined orthodontic/surgical treatment for correction of prognathic mandibles is preferable (15, 31–34). The literature contains only scanty information as to the percentage use of preoperative orthodontics. Swedish reports (7, 35, 36) indicated about 25%; Nakajima et al. (37), in a Japanese study, reported that all their 45 patients had preoperative alignment of the dental arches. In the present study as many as 90% in the age group 15–24 years had preoperative orthodontics, with a decrease in the older patient groups. The different units involved in the present study showed a considerable variation in the use of orthodontics. The reasons for this will be discussed in a later paper.

The hospital stay in the different departments varied significantly. This survey documents the total hospital stay of the patients. The reasons for extended hospitalization may be that presurgical planning was performed with the patient in hospital owing to the special geographical situation in Norway. For the same reasons and for the safety of the patients the postoperative period in hospital may be extended. Åstrand et al. (7) reported a hospital stay of 7.7 days for the EVSO procedure, which is nearly the same as in this study. Wang & Waite (38) found that SSO-operated patients need 1 day more in hospital than the EVSO-operated. In Norway these patients were hospitalized for 13 days. For IVSO Akin & Walters (39) stated a hospital time of 4 days, 1 day shorter than the expected stay according to this study.

The intermaxillary fixation period shows a range and a mean that correspond to those of other reports (7, 39). The fixation time appears to depend mostly on the surgical unit and, to a lesser extent, on the technique.

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