The process of orthognathic care in an NHS region

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ABSTRACT

INTRODUCTION The aim of this study was to evaluate, within an NHS region, the process of care and the standard of record keeping for orthognathic patients.

PATIENTS AND METHODS A retrospective analysis of the medical records of 372 patients who underwent orthognathic surgery between 1 January 1995 and 31 April 2000 in the South West Region of the UK.

RESULTS Most patients underwent joint orthodontic and maxillofacial planning and had third molars extracted under general anaesthesia prior to orthognathic surgery. There was a significant difference in the median operation times and length of stay for bimaxillary surgery (4 h/4 days) compared with single jaw surgery (2 h/3 days; $P < 0.001$). Just over 15% of patients required removal of internal fixation plates after surgery, with nearly 90% of these requiring a further episode of general anaesthesia. The level of record keeping and patient review was variable with no regional standardisation.

CONCLUSIONS This study is evidence of a generally acceptable standard in the process of care, which was found to follow international and national practices. However, at the time of the study there was no regional protocol for patient records or patient review, highlighting the need for the establishment of a regional database.

KEYWORDS

Orthognathic surgery – Audit – Process of care – Record keeping

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There is currently limited literature on the process of care for orthognathic patients within the UK National Health Service. Whilst bodies such as the National Institute for Health and Clinical Excellence (NICE) have been developed to unify ongoing audits and confidential enquiries into such processes,¹ and professional associations have produced guidance into process,² many of the stated guidelines are aspirational rather than evidence-based. In part, this is due to the paucity of available process evidence. Audit data of good quality can be used to monitor process and also redefine service provision, such as the centralisation of care.³ However, if continuous monitoring of care and a forecast of service requirements is to be made, as in the cleft Clinical Standards Advisory Group study,⁴ then a minimum data set is required. Certainly, a basic audit of the process of care would be a way of identifying useful indicators, allowing outcome indicators to be identified and facilitate the development of minimum datasets for orthognathic surgery.

The aims of this present study were to evaluate within an NHS region: (i) the process of care for orthognathic patients; and (ii) the standard of record keeping for these patients.

Patients and Methods

Nine hospital units were identified within the South West Region of the UK as providers of combined orthodontic/orthognathic care on a single site. The inclusion criteria comprised: (i) patients who had their surgery between 1st January 1995 and 30th April 2000; (ii) pre-surgical orthodontics; and (iii) at least one of the jaws was operated on. Exclusion criteria included cases where orofacial clefting and craniofacial syndromes were a feature.

As this study was a process audit using patient records, no formal ethical approval was required. A literature review was undertaken to identify and assess the important aspects of care that might affect process and to derive outcome indicators. Five sets of records of orthognathic patients were assessed by four researchers to determine if these aspects could be easily recorded.

Patients for inclusion were identified by cross-referencing a regional database with at least two other patient data sources, including theatre books, electronic databases, unit

Table 1 Parameters for data collection

- Demographic details
- Referral details
- Malocclusion details
- Treatment plan – both orthodontic and orthognathic
- Extractions – including third molars
- Number of appointments of all types – including orthodontic, oral and maxillofacial surgery, combined, emergency, failed
- Grade of operator
- Complications
- Records – including models, radiographs

databases, operation booking diaries, and computerised hospital patient administration systems. Data collection was piloted in one unit and a summary of the final parameters collected is shown in Table 1.

The records of 489 patients were examined and 372 met the inclusion criteria. The data were analysed using SPSS (SPSS Inc., Chicago, IL, USA). Descriptive statistics were used for the cross-sectional data. Chi-squared tests were used to compare distribution of categorical data where appropriate and non-parametric Mann–Whitney U-tests were used to describe the distribution of skewed continuous data. A reliability study was performed by collecting data on 15 parameters from a random sample of 30 patient records. These were then compared with data from the same patients in the main study.

Results

The reliability study showed high levels of agreement. Within the study group, females outnumbered males by approximately 2:1 (69.4% vs 30.6%). The median age at

referral was 16.1 years (range, 13–54.1 years) and the median age at surgery was 19.8 years (range, 14.5–57.6 years).

Process of care

Most patients were initially referred to orthodontists (78.5%; $n = 292$), with the remainder referred either to maxillofacial surgeons, other dental specialties, ENT or plastic surgery. All were subsequently referred to the orthodontist.

The majority of patients presented with Class II division 1 (47.3%) or Class III malocclusions (43.2%) and 33% had previous orthodontic treatment. A total of 334 patients (90.5%) had at least one joint consultation prior to the commencement of treatment and 329 (89.2%) had at least one joint consultation just prior to surgery. Four patients had no joint appointments, having only seen a maxillofacial surgeon on a separate clinic prior to surgery.

Orthodontic phase

Most patients had their orthodontics performed by a consultant or senior registrar. Less than 10% received treatment from other grades. The effect of operator grade on the number of visits was significant for both pre- ($P = 0.008$) and post-surgical orthodontics ($P = 0.045$). Consultants required significantly fewer appointments, although the overall lengths of pre-surgical, post-surgical and total treatment were not affected by operator grade.

Most treatments were non-extraction (66.9%). Extractions, particularly if carried out in both arches ($P = 0.008$), significantly increased the number of pre-surgical appointments and treatment time ($P = 0.02$; Tables 2 and 3). There was no significant effect of extractions on the number of post-surgical orthodontic appointments ($P = 0.25$), although the length of post-surgical orthodontics was increased by extractions ($P = 0.046$). Non-extraction cases had a median number of 14 pre-surgical orthodontic appointments (range, 1–41) and seven post-surgical appointments (range, 2–20). Pre-surgical orthodontics took a median time of 19.7 months (range,

Table 2 The effect of extractions on the number of orthodontic appointments

	Non-extraction/appointments	Extraction appointments	<i>P</i> -value
Median number of orthodontic appointments pre-surgery	14	15	0.042
Range	1–41	4–38	
Interquartile range	11–17	12–18	
Median number of orthodontic appointments post-surgery	6	7	0.246
Range	2–20	2–14	
Interquartile range	5–8	5–8	

P-values determined by Mann–Whitney U-test.

Table 3 The effect of extractions on the length of treatment

	Non-extraction (months)	Extraction (months)	P-value
Median length of pre-surgical orthodontics		19.3	20.9
Range	0.2–53.65	4.8–62.5	0.019
Interquartile range	15.0–23.8	17.0–27.3	
Median length of post-surgical orthodontics		4.4	4.8
Range	0.5–18.4	1.3–18.1	0.046
Interquartile range	3.2–5.7	3.7–6.4	
Median total length of treatment		25.1	27.1
Range	9.7–64.5	0.9–70.3	0.003
Interquartile range	20.3–29.5	22.5–33.1	

P-values determined by Mann–Whitney U-test.

0.2–62.5 months) and post-surgical a median time of 4.5 months (range, 0.5–3.4 months). Following surgery, nearly all patients wore inter-maxillary elastics (92.4%).

Surgical phase

In the majority of cases, the consultant was recorded as the main operator. Just over 2% of the cases were operated on by other grades and in only seven was a consultant or senior registrar not present.

Of patients with Class II division 1 malocclusions, 56.6% had mandibular surgery alone, while 64.4% of patients with Class III malocclusions underwent bimaxillary surgery. Single-jaw surgery was more frequent in the maxilla (21.3%) than the mandible (14.4%). There was a significant difference in the case mix of the operator grades ($P = 0.001$) with consultants performing a greater number of bi-maxillary procedures. In 40 operations, additional procedures including

genioplasty, rhinoplasty and face-lifts were performed. On cross-tabulation and chi-squared analysis, additional procedures were not carried out in any greater proportion in maxillary, mandibular or bimaxillary surgery ($P > 0.05$).

Intermediate positioning wafers were used in the majority of cases involving bimaxillary surgery (88.8%). Final wafers were used in less than 45% of cases of single jaw maxillary surgery, increasing to 71.3% for mandibular surgery and 84.6% for bimaxillary surgery. Of records, 5.7% gave no indication as to final wafer use.

Internal fixation plates were used in most cases either alone (86.7%) or in combination with other fixation techniques (*e.g.* intermaxillary fixation [7.3%]; Table 4). Twenty-three patients required postoperative intensive care nursing, eighteen for one night and five for two nights.

Postoperatively, 15.1% of patients required plate removal and mostly under general anaesthesia. A relatively small number (3.5%) required re-operation.

Other complications (*e.g.* blood loss, neurosensory deprivation) were not systematically or routinely recorded.

The median operation time for bimaxillary surgery (4 h) was nearly twice that for single jaw surgery ($P < 0.001$). There was no significant difference in the operation times between single jaw maxillary and mandibular surgery. The median length of stay after single jaw surgery was 3 days, which was significantly less than bimaxillary surgery (4 days; $P = 0.001$). Patients were either admitted on the day of surgery (44%), or the day before (55%). A minority (3%) were admitted 2–4 days prior to surgery. Length of stay was unaffected by the grade of surgeon ($P = 0.071$).

Figure 1 is a scatter plot of the length of stay versus the operation time. Using Kendall's test, a significant correlation was seen between length of stay and operation time ($P < 0.001$). Further investigation showed that for bimaxillary surgery there was a significant correlation between operation time and length of stay ($P = 0.018$), with an even greater

Table 4 Types of surgical fixation used

Fixation method	Number of patients	
	Frequency	%
Inter-maxillary fixation (IMF)	16	4.3
Rigid internal fixation (plates)	321	86.7
Bicortical screws (screws)	1	0.3
Resorbable plates	1	0.3
IMF/plates	25	6.8
Transosseous wires	1	0.3
Plates/screws	2	0.5
IMF/plates/screws	2	0.5
Not recorded	1	0.3
Total	370	100

significance for single jaw surgery ($P < 0.001$). The data showed that as operation time increased so did the postoperative length of stay.

The majority of patients (56.8%) had third molars extracted, usually before their orthognathic surgery (68%) and mostly under general anaesthesia (55.7%).

Following completion of active treatment

At 1-year postoperative, 69 patients (18.8%) had worn their retainers for less than a year, while six patients (1.6%) had not worn retainers at all.

The majority (75%) of patients were seen at least 1-year post-surgery. Some (12%) failed to attend. The 2- and 3-year follow-up rate was less than 50%. Few patients reached 5-years postoperatively within the study period.

Standard of the records

Most cases (86.8%) had a written treatment plan, while 13.2% had no evidence of any plan. Most (87.1%) had pre-orthodontic lateral cephalogram radiographs, of which 93.0% were available. Overall, 84.6% had both start and finish study models, while 4.5% had neither within their record.

Discussion

Process of care

ORTHODONTIC PHASE

In the present study, most of the cases were either Class III or Class II division 1 malocclusions, which agree with the findings of the British Orthodontic Society national audit.⁵ Disappointingly, one-third of patients had received previous

orthodontics in an attempt to correct their malocclusion, which is slightly higher than has been found previously (29%),^{5,6} representing a significant proportion of 'failed' orthodontic diagnoses. Despite the lack of a treatment plan in some instances, over 90% of patients had a joint consultation with the surgeon and orthodontist prior to treatment, mirroring the national picture,⁵ which is considered good practice.⁷

Senior clinicians treated the vast majority of patients, suggesting that orthognathic care is considered to be at a level of complexity requiring skilled operators. Previous work has suggested the overall treatment time is shorter with more experienced orthodontists (≥ 10 orthognathic cases/year).⁸ Although the present study showed that consultants finished their pre- and post-surgical orthodontics in fewer appointments, overall treatment times were similar, perhaps because the consultants were still supervising the cases. Total length of treatment (25.8 months) was slightly longer than reported in previous studies.^{6,9}

A third of the patients within the study underwent orthodontic extractions as part of their treatment, compared with 21–67% reported in previous studies.^{5,6,9} On average, this increased pre-surgical treatment time, but only by 1.5 months, whereas previous studies have shown an increase of 4.4 months.⁶

SURGICAL PHASE

In the present study, bimaxillary surgery was performed on the majority of Class III cases, with very few procedures involving posterior movement of the mandible alone. A third of patients in the Class II division 1 group also had bimaxillary surgery, although mandibular advancement alone was the most popular surgical correction. Both sets of figures were almost identical to those seen in the British Orthodontic Society national audit.⁵

In the majority of cases a final positioning wafer was recorded as being used and intermediate and final wafers were used in over 80% of cases involving bimaxillary surgery. Spatial positioning of the maxilla is considered more critical than the mandible.¹⁰ Interestingly, in less than half of the cases where the maxilla alone was moved was a positioning wafer used.

Despite the advantages of using plates for rigid internal fixation, a number of complications were documented. Over 15% of patients had plates removed because of discomfort, dehiscence or infection, and over 90% of these required a further episode of general anaesthesia. This is a little higher than the 12% complication rate reported by Manor *et al.*¹¹

Interestingly, there was no significant difference between the operating times or lengths of stay for consultants and non-consultants. This could be because non-consultants perform fewer bimaxillary procedures but their

single-jaw surgery takes longer to perform. Also, surgeons under training will usually have a consultant present and either might be recorded as the main operator.

The median length of stay for all procedures was 3 days, which compares well with previously published data where the length of stay was 5 days.¹² The correlation (Fig. 1) between the length of operation and the length of stay was shown to be highly significant. Previously, anaesthetic time has been shown to affect the length of stay when day-stay surgery is planned.^{15,14} Exceeding 4 hours 28 minutes means patients are more likely to require admission.¹⁵ Increased blood loss and length of operation are also associated with increased recovery time from operation.¹⁵

Therefore, although there is a move towards day surgery in order to reduce costs, the present study shows that exactly 100 patients were discharged within 2 days of surgery. However, only seven of these were discharged within 24 h and most of these had just single jaw surgery.

Most patients had their third molars removed and almost 70% prior to jaw surgery, presumably to reduce the likelihood of an unfavourable split during mandibular osteotomy and to facilitate rigid internal fixation.^{7,16} However, recent evidence suggests third molars could be removed at the time of osteotomy. Mehra *et al.*¹⁷ studied 262 patients who had had a total of 500 sagittal split mandibular osteotomies, 250 splits with third molars present and 250 where there were none. Overall, the presence of lower third molars and their extraction at the time of mandibular osteotomy did not increase the chances of unfavourable splits to a great degree. Of patients in the present study, 30% had extraction of third molars during the orthognathic procedure and, again, there was no significant increase in the length of operation. The extraction of third molars during orthognathic surgery may remove the need for additional general anaesthesia, be more convenient for the patient and reduce overall costs to the NHS.

The standard of records

The British Orthodontic Society suggests good practise exists where 'clinical notes set out the presenting problem, history, diagnosis, diagnostic results, treatment goals and treatment plans', which is re-iterated in the General Medical Council's *Good Medical Practice* guide.^{18,19} A failure to follow these guidelines may compromise any defence of treatment if the patient subsequently pursues a complaint or litigation. In the present study, over 13% of cases did not have a written plan. Similarly, almost 13% of records did not have a pre-orthodontic lateral cephalogram and 7% no pre-surgical lateral cephalogram. It could be argued that all patients would require such radiographs prior to complex multidisciplinary treatment. It may be that for some patients the radiographs were lost or were being held centrally. With the introduction of PACS, the location of previously taken

radiographs should be straightforward and a repeat of this study in the future would be worthwhile.

The incorrect coding of data in electronic databases was highlighted in the present study and is a common problem.^{20,21} Inaccurate data entry not only has medicolegal implications but, in an era of payment by results, also has direct financial consequences. It begs the question whether or not such coding should be delegated to non-clinical staff.²²

Conclusions

The process of orthognathic care in the UK South West Region has been described and in general is of an acceptable standard. Within the surgical phase it differs slightly from previous reports in that up to 15% of patients may require removal of internal rigid fixation plates after surgery. Third molar removal is predominantly carried out prior to osteotomy, whereas recent evidence would suggest this might be done at the time of osteotomy.

The follow-up and record keeping for orthognathic patients is not standardised and does not seem to be based on published evidence. Accurate data collection and recording are essential, not only for medicolegal reasons but also financial management.

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