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Orthognathic Surgery: 2. What is it all about?

Abstract: This article highlights the aspects of treatment that the GDP needs to be conversant with when referring patients for orthognathic surgery. An overview of the management pathway is also outlined.

Clinical Relevance: General dental practitioners should have sufficient knowledge about the orthognathic care pathway, from the referral point until the end of treatment, to allow them to inform a patient what they are likely to experience.

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Orthognathic treatment comprises a combination of orthognathic surgery and orthodontics aimed to correct sagittal, vertical and transverse dentofacial discrepancies.¹ There is no definitive aetiological cause for these deformities, but family history is known to play an important role.² Facial disproportion usually presents as deviations from the norm in the size and/or position of the jaws and, in its extreme manifestation, significantly affects both function and appearance.

The majority of patients are referred to the orthodontist or maxillofacial surgeon by the general dental or medical practitioner.² It is probably better to encourage initial referral to the orthodontist as he/she is more likely to insist upon the collection of high quality clinical records, including orthodontically trimmed study models and good intra-oral and extra-oral photographs and all relevant radiographs prior to the appointment at the joint orthognathic clinic. During the initial consultation visit, the treatment options can then be thoroughly discussed with both the patient and his/her parents or partner and a decision as to whether the patient is suitable for, and willing to undergo, orthognathic treatment, can be made. One of the most important factors assessed during the initial stages is self-

motivation, which is imperative from the outset, particularly when considering proposed treatment of extremely long duration and complexity.

The most common reasons for patients to seek treatment are 'to have straight teeth', 'to prevent future dental problems' or 'to improve self-confidence'. Only those patients for whom facial growth is largely complete are considered for orthognathic surgery.²

Common indications for seeking a surgical option include:³

- Inability to retrude or protrude the lower jaw into a position where the incisors can incise food;
- Presence of a skeletal open bite;
- True asymmetry of one or both jaws;
- Abnormal vertical jaw relationship.

Retrospective studies have shown that the standard agreed care pathway in a hospital setting (involving both orthodontic and orthognathic surgery) lasts, on average, for about 30 months.⁴ The majority of the time and expense is spent in out-patient clinics, which accounts for almost half of the total treatment costs. The costs for treatment of an orthognathic patient, on the NHS, ranges from £4484.41 to £6168.67.⁵ The multidisciplinary team approach is a vital key to success in the management of this group of patients. Members of the team

should include a consultant orthodontist, consultant maxillofacial surgeons, as well as a maxillofacial technician. Other members of the team whose expertise may be called upon are a specialist in restorative dentistry, a speech therapist, and even a plastic surgeon may be required on individual patient basis. Access to the services of a clinical psychologist is also felt to be increasingly necessary. Joint clinics enable close liaison between these professionals for a satisfactory outcome and better patient care.² The main goals of treatment are to:⁶

- Improve dentofacial aesthetics;
- Produce a more balanced functional and stable occlusion;
- Improve the quality of life, including the psychological element.

The standard orthognathic care pathway for a given patient usually includes the following stages:

- History and examination;
- Investigations;
- Treatment plan;
- Pre-operative orthodontics;
- Surgery;
- Post-operative orthodontics.

History and examination

The main purpose of taking a history is to determine the patient's main complaint and to assess his/her suitability

Patient details (place sticker here)		Responsible health professional	
Surname:		Name: Mr P. J. Sandler	
Forename:		Job title: Consultant	
Date of birth:	Hosp No:		
(*Chesterfield Royal Hospital NHS Foundation Trust / British Orthodontic Society)			
A. Orthodontist		Patient information given (delete as appropriate)	
Proposed procedure (tick)		Additional details (if required)	
<input type="checkbox"/> Extractions		CRHFT / BOS*	
<input type="checkbox"/> Removable appliance		CRHFT / BOS	
<input type="checkbox"/> Functional appliance		CRHFT / BOS	
<input type="checkbox"/> Fixed appliance		CRHFT / BOS	
<input type="checkbox"/> Anchorage supplementation		CRHFT / BOS	
<input type="checkbox"/> Retainers		CRHFT / BOS	
I have discussed the nature of the orthodontic treatment proposed, the intended benefits, serious or frequently occurring risks as detailed in the patient information leaflet, any extra procedures that may become necessary and such appropriate options as are available to the patient &/or person with parental responsibility. No tissue samples will be taken/tested/examined/retained or disposed of during the proposed procedure.			
Orthodontist (print name).....		Signature..... Date.....	
Contact details for further advice information from the Orthodontic department: 01246 512103			
B. Patient and/or person with parental responsibility			
Clinical records: study models, photographs and x-rays may be used for teaching and medical publication			
Please indicate agreement: Yes <input type="checkbox"/> No <input type="checkbox"/>			
I agree to and understand:			
<ul style="list-style-type: none"> The orthodontic treatment proposed and explained to me, including the risks, benefits, and options The length of time and commitment required for the orthodontic treatment to be effective That changes may need to be made to the treatment plan, but these will be explained in detail if required There is no guarantee as to the Orthodontist carrying out the treatment. The Orthodontist will, however, have appropriate experience That it may be necessary as part of the treatment to use local anaesthesia That no tissue samples will be taken/tested/examined/retained or disposed of during the procedure 			
Name (print).....		Signature..... Date.....	
Patient/person with parental responsibility (delete as appropriate)			
D. Consent to clinical illustration			
I do not give consent for photographs and/or videotape and sound recordings to be made			
Name (print).....		Signature..... Date.....	
Patient/person with parental responsibility (delete as appropriate)			
I give consent for photographic and/or videotape and sound recordings (the 'material') to be made, that the purpose for which the material will be used has been explained to me in terms which I understand, and I agree to the use of the material in the following circumstances: (please tick the appropriate boxes below and sign)			
I understand the material will form part of my confidential treatment records and has value in clinical assessment and I agree to this use of the material <input type="checkbox"/>			
I understand the material has value in medical education and I consent to the material being shown to appropriate professional staff for the purpose of education, staff training and professional development <input type="checkbox"/>			
I give consent for the photographic recording made to be published in an appropriate journal or textbook. It is understood that I have the right to withdraw consent at any time prior to publication but that once the images are in the public domain there may be no opportunity for the effective withdrawal of consent <input type="checkbox"/>			
Name (print).....		Signature..... Date.....	
Patient/person with parental responsibility (delete as appropriate)			
E. Statement of interpreter			
I have interpreted the information above to the best of my abilities and in a way I believe the patient/person with parental responsibility understands.			
Name (print).....		Signature..... Date.....	
Top copy accepted by patient/person with parental responsibility (delete as appropriate): Yes <input type="checkbox"/> No <input type="checkbox"/>			

Figure 1. Consent form must cover all possible risks or side-effects of treatment.

for a particular approach. Amongst many other factors, a detailed medical history or any co-morbidities are noted, particularly those that might influence the patient's fitness to undergo surgery. The clinician's opinion of 'need for treatment' may be greater than that of a layperson⁷ because clinicians often tend to be more critical of facial appearance than the general public.

This is the stage at which all the patient's expectations from the treatment need to be explored and any limitations of the treatment should be thoroughly explained in order for the patient to be in a position to give a fully 'informed consent'. Each and every possible adverse outcome

must be discussed in detail with the patient and it must be documented in the clinical notes that this has been done. It would be useful for a written sheet to be given to the patient at this stage, again reiterating the possible problems that may occur either with the orthodontic or the surgical part of the treatment. If the said sheet is available, it should also be documented in the notes that this has been given to the patient (Figure 1).

Clinical examination involves:

- Frontal assessment;
- Profile assessment;
- Temporomandibular joint examination;
- Comprehensive intra-oral examination;

- Any altered sensation record.

Many departments tend to use their own data collection sheets and all the above aspects must be completed as a minimum dataset (Figure 2).

Investigations

Investigations supplement all the information gained from the history and examination and include plain radiographs, namely a panoramic film, and a true lateral skull radiograph, orthodontically trimmed study models and extra-oral and intra-oral photographs.² Pre- and post-operative photographs, as well as being an essential clinical tool, are usually also utilized for surgical audit, teaching and may need to be available for medico-legal reasons⁶ (Figure 3).

Before a diagnosis is reached, further radiographic analysis is always undertaken. Cephalometric analysis is helpful in establishing the relationships between the cranial base, the upper and lower jaws and the dentition. This can be carried out by manual tracing of the radiograph or by examining the digital cephalometric radiographs on screen, using specialist software packages such as *Orthotrac*, *Dolphin* or *QuickCeph*.⁸ Such simulation programmes not only allow full measurement of the AP and vertical discrepancy, but also purport to predict skeletal and soft tissue responses to surgery, so that patients and clinicians are able to see a visual 'representation' of the surgery outcome. However, one has to bear in mind that algorithms used in prediction are inherently inaccurate, so there may be significant clinical differences for all predicted vertical and horizontal measurements.⁹ These orthognathic 'predictions' must be used with caution and patients are usually warned repeatedly about this prior to treatment planning^{9,10} (Figure 4).

Treatment plan

The diagnosis of the patient's malocclusion can usually be made after the first clinical examination, but an initial treatment plan is finalized when all the necessary investigations have been carried out and the results evaluated. Many restorative, periodontal or orthodontic problems will have to be considered in detail before this treatment plan can be shared with the patient and his/her partner/parents. If there are a number of possible approaches, then the pros and cons of each approach need to be discussed in detail with the patient and

24 No. _____

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DEPARTMENT OF ORTHODONTICS

EXAMINATION AND DIAGNOSIS FORM

SURNAME _____ RECORD No. _____

FORENAMES _____ M/F _____

DATE OF BIRTH _____

ADDRESS _____

DATE OF EXAM D/O	GDP HPC	AGE MEDICAL HISTORY	FH				
SKELETAL PATTERN FMPA MAX MAND I <input type="checkbox"/> MILD <input type="checkbox"/> HI <input type="checkbox"/> PROG <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> II <input type="checkbox"/> MOD <input type="checkbox"/> AV <input type="checkbox"/> AV <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> III <input type="checkbox"/> SEV <input type="checkbox"/> LD <input type="checkbox"/> RETROG <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		SOFT TISSUES LIPS LIP LINE LIP POS'N TONGUE COMP <input type="checkbox"/> HIGH <input type="checkbox"/> LAB <input type="checkbox"/> THRUST <input type="checkbox"/> INCOMP <input type="checkbox"/> AV <input type="checkbox"/> PAL <input type="checkbox"/> TTLL <input type="checkbox"/> THICKNESS LOW <input type="checkbox"/> NLA LISP THICK <input type="checkbox"/> E-PLANE <90° <input type="checkbox"/> ANT <input type="checkbox"/> MOD <input type="checkbox"/> U.....mm 90°-110° <input type="checkbox"/> LAT <input type="checkbox"/> THIN <input type="checkbox"/> L.....mm >110° <input type="checkbox"/> DIGIT <input type="checkbox"/>		TEETH ERUPTED UNERUPTED BUCCAL PALATAL			
UPPER ARCH CROWDING INCLINATION GINGIVAL DISPLAY MILD <input type="checkbox"/> NONE <input type="checkbox"/> PROCLINED <input type="checkbox"/> RESTmm MOD <input type="checkbox"/> SPACED <input type="checkbox"/> AV <input type="checkbox"/> SMILEmm SEV <input type="checkbox"/> FRENUM <input type="checkbox"/> RETROCLINED <input type="checkbox"/>			LOWER ARCH CROWDING INCLINATION CURVE OF SPEE MILD <input type="checkbox"/> NONE <input type="checkbox"/> PROCLINED <input type="checkbox"/> DEEP <input type="checkbox"/> MOD <input type="checkbox"/> SPACED <input type="checkbox"/> AV <input type="checkbox"/> MOD <input type="checkbox"/> SEV <input type="checkbox"/> RETROCLINED <input type="checkbox"/> FLAT <input type="checkbox"/>				
INCISOR CLASS I <input type="checkbox"/> III <input type="checkbox"/> II/1 <input type="checkbox"/> BIMAX <input type="checkbox"/> II/2 <input type="checkbox"/> I/INT <input type="checkbox"/> Comments:		OVER JETmm Incisor Show at Restmm on Smilingmm		OVERBITE Increased <input type="checkbox"/>mm Average <input type="checkbox"/> Reduced <input type="checkbox"/> Edge to Edge <input type="checkbox"/> Complete <input type="checkbox"/> HT <input type="checkbox"/> Incomplete <input type="checkbox"/> ST <input type="checkbox"/>		CENTRE LINES MIDFACE <input type="checkbox"/> U L Molars R <input type="checkbox"/>UNIT <input type="checkbox"/> L <input type="checkbox"/>UNIT <input type="checkbox"/> Canines R <input type="checkbox"/>UNIT <input type="checkbox"/> L <input type="checkbox"/>UNIT <input type="checkbox"/>	
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Figure 2. Extra-oral and intra-oral examination recorded on standard form.

documentation of the discussions made in the clinical notes.

It should be explained to the patient that the specific surgical procedures cannot be decided upon at this stage, and it will be only after 12–18 months pre-surgical orthodontics, once the response to that treatment can be assessed and measured, that specific surgical movements can be planned.

Pre-operative orthodontics

Pre-operative orthodontics is undertaken by a specialist or consultant

orthodontist and usually takes an average of 18 to 24 months to complete.¹¹ Longer pre-surgical orthodontic treatment is usually more acceptable to patients than post-orthodontic treatment and leads to better overall compliance.¹² The primary goals of pre-surgical orthodontic treatment are to align the dentition, sometimes to level the occlusal plane and almost always to decompensate the dento-alveolar segments. This removal of the dental compensation for the surgical discrepancy maximizes surgical correction of the deformity, and may improve final stability.⁶ At the end of this pre-surgical decompensation stage, the

malocclusion will often look much worse than before, although the patients are always warned repeatedly about this at earlier stages (Figure 5).

The resultant pre-surgical jaw and dental relationships are recorded at this stage on presurgical models so that, with the help of a technician, the actual jaw movements required to correct the deformity can be represented on an articulator. The orthodontist is also responsible for checking the occlusal wafers which are prepared in the laboratory from cold cured methyl methacrylate. During surgery, these wafers locate the upper and lower dentitions in the correct relationship to each other so that the jaws can be plated in the correct position (Figure 6).

Surgery

Informed consent is mandatory. Patients should be well informed about the risks and complications of the planned surgical procedure. It is also essential to give accurate advice about the immediate post-operative period and the best ways to make it more comfortable. In her *Diary of an Orthognathic Patient*, Murphy highlights a few main concerns that should be discussed with the patient prior to surgery.¹² These include:

- Post-operative morbidity caused by swelling and bruising;
- Dribbling caused by numbness;
- Pain in the jaw joints; and
- The 'low feeling' that accompanies the procedure for a few days post-operatively.

Pre-operative

Most patients are admitted the night before or even the same morning of the surgery. Pre-operative investigations usually include haemoglobin level and full blood count, as well as a group and save. Other tests might be required on an individual basis. Typical examples would be:

- The sickle cell anaemia test, for diagnosing any abnormalities in haemoglobin genes like sickle cell disease in susceptible individuals;
- The taking of chest radiographs to diagnose any chest condition prior to a general anaesthetic; the latter test is usually requested by the anaesthetist and this is not usually the case for young fit adults. The patient is usually also fully assessed by the anaesthetist either at a previous outpatient visit or on the ward.

During surgery

The actual surgery time will vary enormously, depending upon the preferences of the surgeons and the

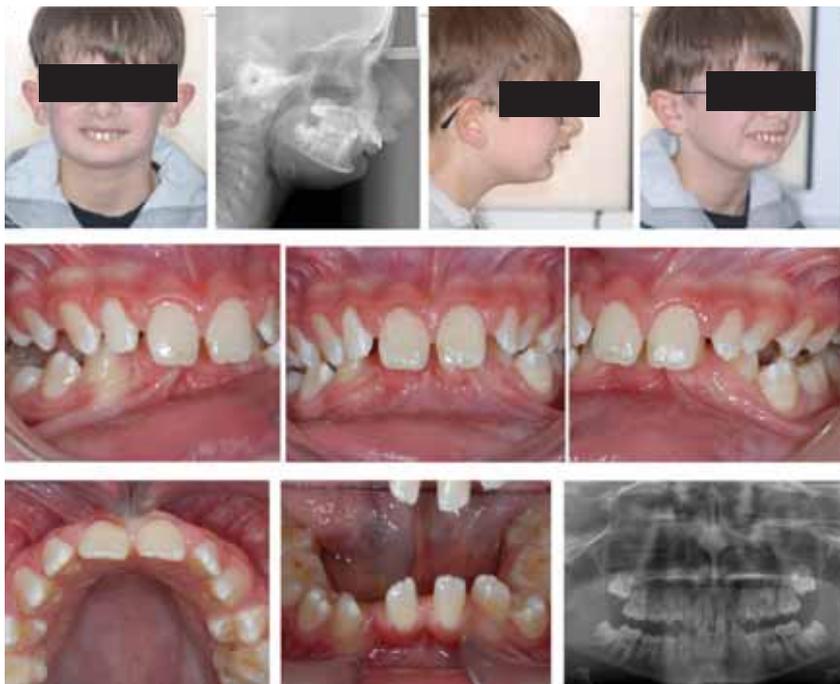


Figure 3. Standard photographic and radiographic records as a basic record for every patient.

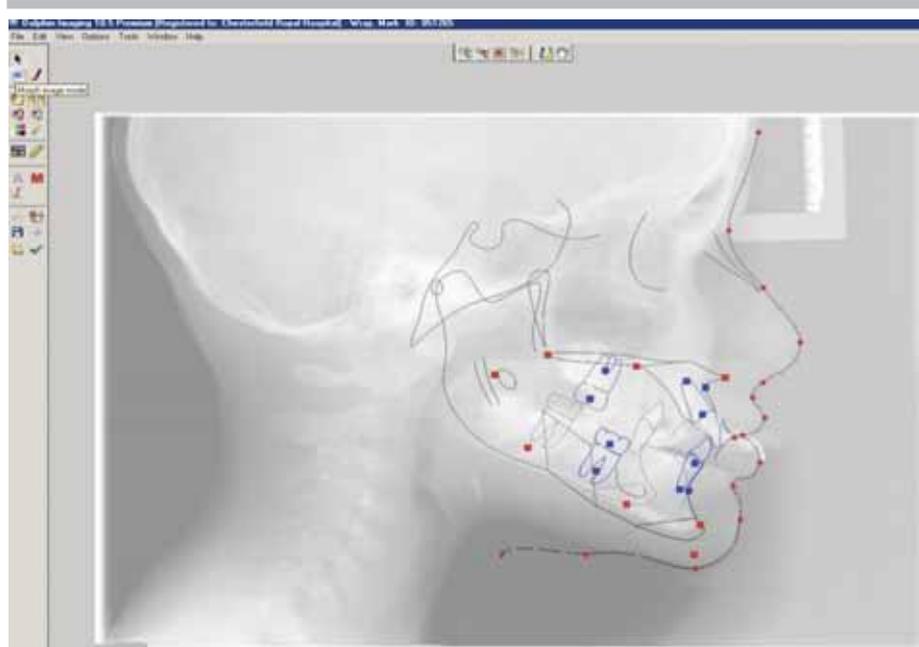


Figure 4. Surgical prediction is not an accurate representation only an indication of the kind of change that might be achieved.



Figure 5. Decompensating cases make appearance worse during orthodontics.



Figure 6. Models accurately positioned during surgery using interocclusal wafer made with the aid of an articulator.

anaesthetists, and may range from about 90 minutes, for a sagittal split osteotomy, to approximately 3–4 hours for a bimaxillary procedure. Occasionally, wisdom teeth removal is also carried out at the time of surgery, although most surgeons like to have a six-month healing period prior to a sagittal split osteotomy. During the actual procedure, the patient may be catheterized and he/she should be warned about this in advance. Minimal antibiotic regimes are usually advocated for such surgery, but some surgeons prefer to start an antibiotic dose at induction and continue it orally for the following 3 days. Such practice is thought to reduce the incidence of post-operative infection.⁶ A dexamethasone dose is usually also given at induction but repeated later on the ward to reduce post-operative swelling. The patient should not be left with any external significant scars as most modern orthognathic procedures use an intra-oral approach. However, puncture wounds may be necessary if drains are used. The patient should again be warned about the small stitches and possibility of tiny scars as a result of these drains.

Post-operative

Once back on the ward, the patient should be nursed at 45° and another set of blood tests is repeated to check the haemoglobin level. Pain control is important to make the patient as comfortable as possible, but it may vary from subcutaneous morphine to a patient controlled administration pump system.

On the first post-operative day, the occlusion is checked, ideally by the orthodontist, together with the maxillofacial surgeon who carried out the procedure, and elastics are applied to the appliance by the orthodontist as required. Chlorhexidine mouthwash is the only form of oral hygiene a patient might be able to manage at this immediate post-operative stage. Patients will need to start managing some fluids, perhaps through a straw or a feeder cup, as soon as they can as discharge from hospital will be influenced by how quickly they can drink. Lip control is quite difficult owing to the extensive numbness that usually accompanies post-operative swelling. Patients are discharged as early as the second post-operative day,¹³ but certainly need more time, up to a couple of weeks, to recover at home, before they return to work or study. Patients are also advised to use food blenders during the first few weeks after the surgery.¹²

Post-operative orthodontics

Patients need a lot of

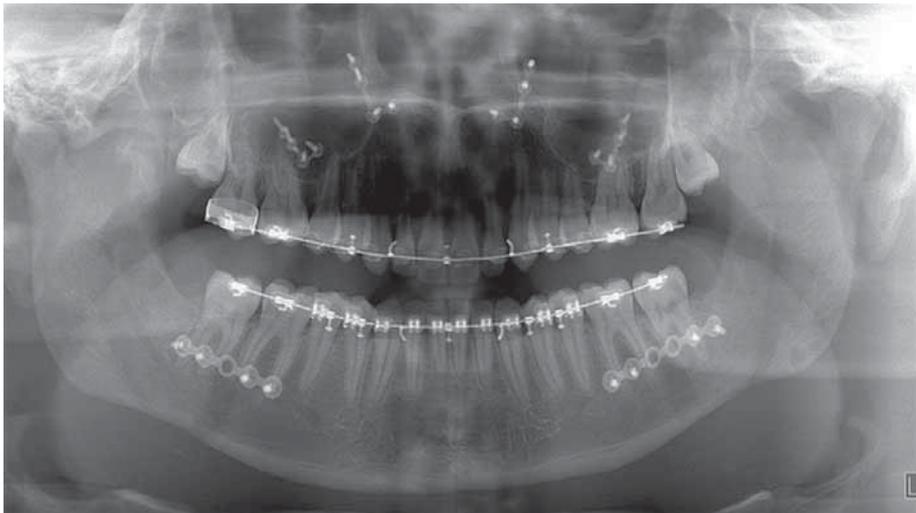


Figure 7. Titanium plates fix the jaws post-operatively and are usually left in place if asymptomatic.



Figure 8. Decalcification inevitable on fixed appliance removal if diet and OH are substandard.

reassurance at the first review appointment because it is psychologically quite difficult to adapt to all the post-operative discomfort, as well as a swollen new face!¹² The post-operative orthodontic phase may last 5 to 11 months.¹⁴ The primary goals are to finalize tooth positioning, ensuring a good functional as well as static occlusion. Once the debond is carried out, the patient is followed up as an outpatient on joint orthognathic clinics for up to 5 or even 10 years.

Complications

Every surgical procedure will carry a certain degree of risk. Most orthognathic patients are likely to be young fit adults, so complications are more likely to be related to the actual treatment itself. The results of a study carried out over a 15-year period shows that only 1.5% of the total number of patients who had undergone orthognathic surgery required further surgery as a result of complications.¹⁵

Bleeding

Any risk of bleeding during the

actual procedure is reduced with careful technique and measures such as local anaesthetic with vasoconstrictors. Mild post-operative bleeding from the wound or the nose is considered normal.

Infection

Titanium plates and screws used for internal fixation during the surgical procedure are usually left in place permanently (Figure 7). If there are any signs of infection at follow-up appointments, it may warrant a second surgical intervention, often under local anaesthesia, for their removal.

Paraesthesia

Nerve damage may be the result of the wisdom teeth removal or the orthognathic surgery itself and patients are warned that there is a 10% chance of this occurring. It is mostly a transient complication which resolves in the first year post-operatively. Prolonged paraesthesia is more common in older adults and when unwanted fractures occur during surgery. The most common nerve to be affected is the inferior alveolar nerve, leading to mental paraesthesia.

Unfavourable fracture

These are not uncommon, especially in the sagittal split ramus osteotomy of the mandible.

Deep vein thrombosis (DVT)

This is more common in females and is minimized by the use of thromboembolic-deterrent stockings worn by the patient during surgery.⁶

Tooth surface demineralization

If oral hygiene is not adequate

during treatment, patients will have irreversible demineralized lesions on the surfaces of their teeth once the fixed appliances are removed (Figure 8).

Relapse

This is a most undesired complication that may arise from inadequate planning or inappropriate surgical technique. Orthodontic relapse is minimized by carefully planning the retention phase of treatment.

Patient satisfaction

Several surveys have reported that patients feel they would benefit from more information about certain aspects of their care, like duration of treatment⁴ and severity of morbidity associated with the surgical procedure. It was found that patients were mostly surprised about the longer time period they needed to recover from the surgery, both physically and emotionally.¹⁶ In view of this finding, some departments believe it would be beneficial to refer patients for a psychological assessment in order to reduce patient anxiety and improve satisfaction.^{17,8} 'Body Dysmorphic Disorder' is a condition which will result in patients being dissatisfied with the final result of treatment. It is therefore important to identify these patients in advance to avoid all the problems associated with the lack of satisfaction with the surgical and orthodontic result. Patient satisfaction is influenced by various other factors besides surgery outcome and quality of care.⁸ These same patients feel that verbal and written explanations could be supported with recommendations of other patients who have actually undergone the same procedure.¹⁸

As a result of this, the British Orthodontic Society have put together a DVD on orthognathic surgery which includes all the information patients require before embarking upon this long and complex journey. It also has interviews with many patients who have had both single and double jaw surgery and gives their perspective of each and every aspect of treatment.¹⁹

Conclusion

This second paper provides general dental practitioners with all the information they require surrounding orthognathic surgery to inform their patients fully. Armed with this information prior to an initial appointment at a Joint

Combined Clinic, the patient can compile a list of useful, specific questions which will result in him/her being able to give truly 'informed consent'.

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