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Limiting Factors in Orthodontic Treatment: 1. Factors Related to Patient, Operator and Orthodontic Appliances

Abstract: Owing to a shortage in the orthodontic work force in the United Kingdom, many general dental practitioners carry out orthodontic treatment in selected cases. Orthodontic treatment may not always be successful as a result of various factors. Some of these limiting factors are related to the practitioner, others to the patient, the orthodontic appliances used and sometimes to the underlying biology. It is essential that practitioners are aware of these limitations. The aim of this two part article is to describe some of the practical aspects that need to be considered.

Clinical Relevance: General dental practitioners and novice orthodontic practitioners may get into difficulties by embarking upon an orthodontic treatment which may not be feasible owing to various limitations of orthodontic treatment.

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Considerable limitations in the clinical application of orthodontic treatment can be imposed by factors related to the patient, operator, orthodontic appliance and the underlying facial biology (Table 1). In this two-part article, we discuss these factors and elaborate on some of the

orthodontic techniques which can be used to overcome these problems. In the first part of this article, we describe the factors which are related to patient, operator and orthodontic appliances. In the second part, we will describe the biological factors which can limit orthodontic treatment.

Patient factors

Age

Age plays an important role in orthodontic treatment. It can limit not only the scope of orthodontic treatment as a whole, but it can also affect the long-term stability of a treated malocclusion. A child may be diagnosed as having a potential malocclusion at a very early age, but it is unusual for any orthodontic treatment to be recommended before the child is in the late mixed dentition. This is because movement of deciduous teeth has no effect on the position of the succeeding teeth, and the permanent premolars

and canines need to have erupted for a definitive result to be achieved. Also, co-operation may be lacking as the young children rarely perceive a problem. There are only a few indications for an early orthodontic treatment, such as a Class III incisor relationship with an associated displacement of the mandible, or obvious hard or soft tissue damage as a result of the malocclusion (Figure 1). Serial extraction, as described by Kjellgren, is rarely if ever indicated in modern orthodontics.¹ Treatment in the late mixed and early permanent dentition is ideal in most cases, as treatment is usually completed within two years. It is also more socially acceptable and compliance is usually better at this age.² The only other cases treated early are the children with malocclusions who are being teased at school because of the dental discrepancy.³ The psychosocial benefit of treatment has recently been established.⁴

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1. Patient factors

- Age
- Attitude
- Poor patient compliance
 - Diet
 - Oral hygiene
 - Elastics
 - Headgear
- Habits
 - Thumb sucking
 - Endogenous tongue thrust

2. Operator factors

- Knowledge and clinical ability
- Availability of resources
- The clinical goals of the operator
- Communication skills

3. Appliance factors

- Removable appliances
- Functional appliances
- Fixed appliances
- Headgear

4. Biological factors

- Patient age
- Patient health
 - General medical health
 - Dental health
- Anatomical factors
 - Hard tissue factors
 - Skeletal discrepancy
 - Amount of alveolar bone
 - Dental compensation
 - Severity of crowding
 - Root morphology
 - Number of teeth
 - Hypodontia
 - Supernumerary
 - Morphology of tooth crown
 - Ankylosed teeth
 - Soft tissue factors
 - Naso-labial angle
 - Fraena
 - Mobility of mucosa
 - Lack of attached gingiva
- Pathology such as a cystic lesion
- Stability/relapse issues

be assessed by checking if a patient's friends, schoolmates or siblings wear any orthodontic appliances.

It is important to identify poor co-operators at an early stage, and highlighting previous failure to co-operate aids the explanation to parents as to why continuation of orthodontic treatment is perhaps unwise without an improvement in the patient's attitude or interest.

Poor compliance

Poor patient compliance imposes severe limitations on the success of orthodontic treatment and prevention is better than cure. It is very important that a comprehensive diagnosis has been made to allow an appropriate treatment plan to be formulated. If the patient needs to wear headgear to reinforce anchorage, it should be fitted prior to any irreversible intervention (eg extraction of teeth). Many patients agree to wear headgear, but compliance should always be confirmed before irreversible steps are taken. The headgear is fitted and the patient is often reviewed for one or two visits before starting any orthodontic treatment. Compliance is checked by asking the patient and the parents about headgear use. However, verbal confirmation is not always reliable. Objective signs of headgear use should be checked for, such as tenderness and slight mobility of the molars and wear of the headgear cap. Also, by asking the patient to place the headgear in the presence of the clinician, compliance is checked by observing how adeptly he/she puts on the headgear. At the time of fitting the headgear, the patients should be provided with headgear calendars, to record the number of hours they wear the headgear on a daily basis, and allow the

Table 1. A summary of the factors which can limit orthodontic treatment.

Attitude

Patients' attitude to both their malocclusion and to fixed appliances plays an important role in the success of orthodontic treatment. Many younger patients are not overly concerned about their malocclusion and referral is usually at the request of the patient's dentist or parents.⁵ The patient must have a positive attitude towards orthodontic treatment, and it is of utmost importance that he/she is made aware at the outset that the proposed treatment is in his/her best interest, and is certainly not for the parents' or the dentist's benefit. If the patient

does not attend regularly for orthodontic reviews, treatment will be prolonged unnecessarily and may be unsuccessful. The more treatment is prolonged, the less the co-operation and the longer treatment will take. It is important to avoid this vicious circle wherever possible!

It has been suggested that peers' acceptance/pressure and social class can have a significant effect on a patient's attitude and acceptance of wearing a brace.⁶ It is prudent to explore, at the initial appointment, a patient's familiarity with braces and his/her parents' attitude towards orthodontic treatment. This can



Figure 1. (a-c) Pre-treatment and post-treatment clinical photos of a 2x4 appliance for correcting Class III malocclusion.



Figure 2. (a-l) A patient with Class II Division 1 malocclusion treated by extraction of upper canines.



Figure 3. A palatal implant for anchorage support in the upper arch.

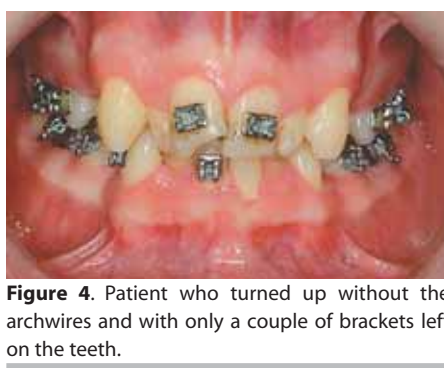


Figure 4. Patient who turned up without the archwires and with only a couple of brackets left on the teeth.

orthodontist to assess compliance. This has been shown to increase the wear by an average of 2.6 hours per day and also increases the accuracy of the patients' estimates of their hours of wear.^{7,8}

Similarly, many orthodontic patients need to wear intermaxillary elastics at some stage during their treatment. The likelihood of headgear, extractions and need for elastics should be made clear to the patient from the outset and reinforced with the use of patient information sheets. It is very frustrating for the patient and for the orthodontist if the desired occlusion cannot be achieved because of compliance issues.

The need for an exemplary standard of oral hygiene as a 'non-negotiable' pre-condition to treatment

should be made clear at the outset and orthodontic treatment should not be started unless the clinician is certain about the patient's ability to maintain the requisite high standard of oral hygiene. Maintaining meticulous oral hygiene during orthodontic treatment is challenging. If patients cannot brush their teeth to a high standard before treatment, it is unrealistic to expect that they will improve once the orthodontic treatment is started. For this purpose, the oral hygiene level is noted in the notes and the patient is given instruction in oral hygiene. The patient is reviewed for a few visits to confirm any necessary improvement in his/her oral hygiene. In some cases, a compromise result may be considered. For instance, in a case with very crowded canines,

where ideally the patient would have had extraction of premolars and wear headgear, canine extraction treatment might be a more realistic and quicker approach (Figure 2). We must emphasize that extraction of upper canines is rarely carried out for overjet reduction. However, in many cases it is better to wait until maturity brings about motivation.

In cases where the patient will not agree to wear a headgear and/or intermaxillary elastics, alternative methods of anchorage support may be explored, for instance, palatal implants⁹ (Figure 3).

Dietary restrictions are another factor which should be taken into consideration as many patients will need to give up eating hard and sticky foods temporarily. An explanation of potential problems associated with such foods at the beginning of orthodontic treatment will save a great deal of clinical time repairing multiple breakages (Figure 4).

Habits

There are several habits which may compromise orthodontic treatment and the first to be described here is digit sucking. Forty percent of the children with a digit-sucking habit in their first year of life may still have this habit at nine years of age, although most of the children will give up this habit in their early teenage years.¹⁰

Such a habit is often associated with an anterior open bite and a posterior crossbite if it persists for a long period. A significant spontaneous improvement may occur if the habit is stopped before the pubertal growth spurt.¹¹ Orthodontic treatment of a malocclusion associated with such a habit is deemed to fail if appropriate measures are not taken to stop the habit. Different orthodontic appliances, both fixed and removable, are used to help the child stop such a habit. In some cases, simple tape on the thumb as a reminder to the patient may help (Figure 5).

In the literature, attention has been drawn to two types of tongue thrust; adaptive and endogenous.¹² Rarely, the tongue thrust may be associated with a macroglossia, however, clinically it may not be possible to differentiate between the two conditions. In the acquired form, the tongue thrust may be secondary to the anterior open bite and necessary to achieve an oral seal during swallowing and speaking. This type of tongue thrust can be successfully treated with appliances (Figure 6). With endogenous tongue thrust, the open bite may be secondary to the persistent anterior tongue thrust. Such malocclusions have a poor prognosis from a stability point of view and relapse is a common occurrence.

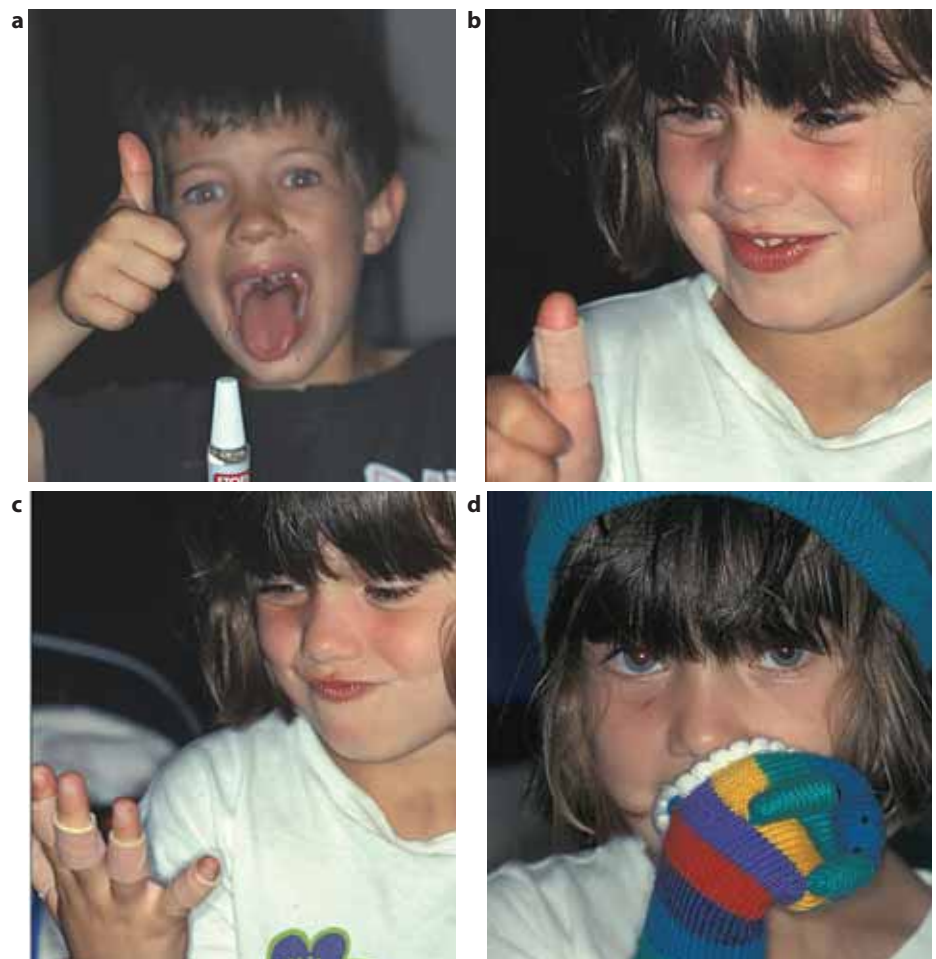


Figure 5. Hierarchy of treatment for patients who suck their thumbs: (a) Stop 'n' Grow; (b) single plaster; (c) multiple plasters; (d) woollen gloves.

Operator factors

Knowledge and clinical ability

The operator's knowledge and clinical competence in the specialty of orthodontics is another limiting factor in orthodontic treatment. The patient's malocclusion may be amenable to orthodontic treatment, but the operator's limited training to deal with a particular problem may limit the quality of orthodontic treatment. For instance, a general practitioner may be able to treat simple orthodontic problems, such as a Class I malocclusion, to a high standard with fixed appliances, but more complicated malocclusions often need to be referred to a specialist for an appropriate treatment. Functional appliances are deceptively simple for the treatment of significant malocclusions, but their effective use relies upon expert diagnosis and treatment planning (Figure 7).

The general dental practitioner should, however, be aware of the GDC's guidance on 'Ethics in dentistry'. Unsatisfactory treatment or failure to provide treatment without adequate skill and/or equipment can lead to civil cases of negligence, disciplinary proceedings by Health Authorities, referral to an NHS Tribunal or allegations before the GDC of serious professional misconduct.¹³

Availability of resources

The practitioner may be capable of dealing with a particular malocclusion but, owing to a lack of necessary resources, the patient may have to be referred to a hospital. A patient's treatment may, for instance, require a multidisciplinary approach involving a combined orthodontic and surgical/restorative treatment. Such cases may be better

treated by referral to a hospital where a multidisciplinary team works together on a daily basis.

In addition, in many third world countries, fixed appliance treatment may not be available and removable appliances may be the prevalent method of treatment.



Figure 6. Anterior open bite associated with digit sucking treated initially with a hayrake appliance.

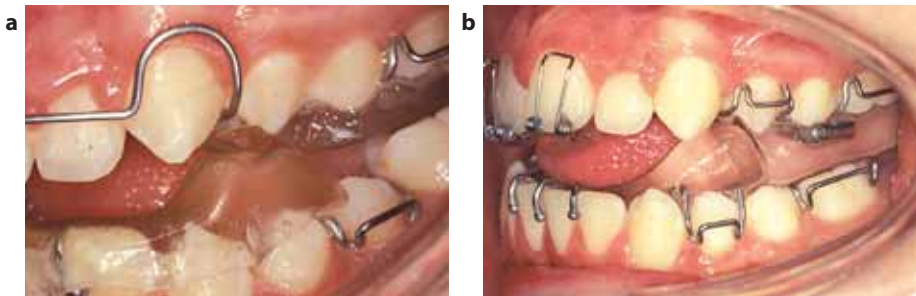


Figure 7. An incorrectly made twin-block appliance with totally inadequate inclined blocks (a), replaced with an appropriately made appliance (b).

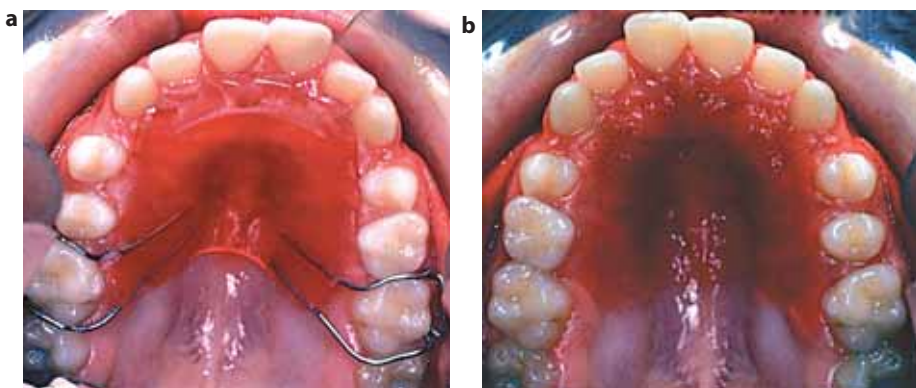


Figure 8. (a–b) Candidal infection of the palate due to inadequate cleaning of upper removable appliance.

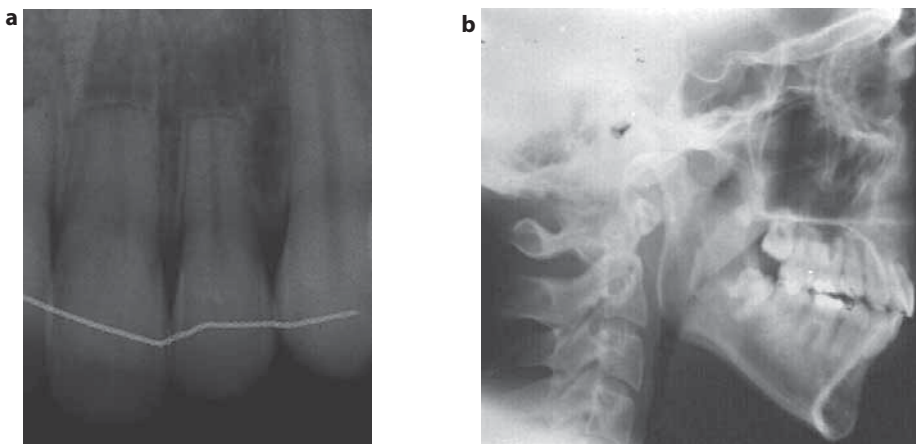


Figure 9. (a–b) Root resorption of upper incisors caused by the use of fixed appliances.

In such cases the scope of orthodontic treatment will be limited.

The clinical goals of the operator

Sometimes, the practitioner may be well trained and have all the necessary resources, but he/she may not be enthusiastic enough about orthodontics to offer an ideal treatment result to the patient. This lack of aspiration may also

result in a compromised treatment to the patient. Achieving excellent static and dynamic occlusal outcomes for our patients is much more demanding for the orthodontist and the supporting team compared to confining treatment to alignment of the labial segment teeth only, which is often enough to satisfy the less enlightened patients. Letting patients dictate treatment plans will often result in severe clinical compromises.

Communication skills

Communication is one of the keys to success and, if the operator cannot communicate effectively with the patient, inappropriate treatment may result. If the patients are not provided with all possible treatment options, including the benefits and risks associated with each treatment, and also the details of their responsibilities throughout treatment, they may opt for an inappropriate treatment which will inevitably result in a compromise outcome. The importance of informed consent cannot be overemphasized and the patient must understand the pros and the cons of each treatment option, to ensure an outcome that is acceptable to both the clinician and the patient.

Appliance factors

Removable appliances

The type of appliance can limit the scope of orthodontic treatment. Single arch removable appliances are less commonly used in the Western world and fixed appliances are now used routinely. This is mainly due to the limited range of tooth movements achievable when using removal appliances. Usually, only tipping movements are easily achieved with removable appliances and effective bodily tooth movement cannot be performed. In some cases, use of removable appliances can even make the malocclusion worse rather than better, if they are used inappropriately. The same applies, however, to fixed appliances.

Candidal infection is not an uncommon occurrence when wearing upper removable appliances if the appliance hygiene is less than ideal (Figure 8). The dentist should be aware of this and appropriate measures should be taken to treat the infection. Oral hygiene improvement, meticulous cleaning of the appliance and, in some cases, the use of antifungal agents are necessary.

Functional appliances

Functional appliances, usually for correcting Class II malocclusions, are only effective during the active growth period. There is a great deal of controversy over whether functional appliances can actually grow the mandible in

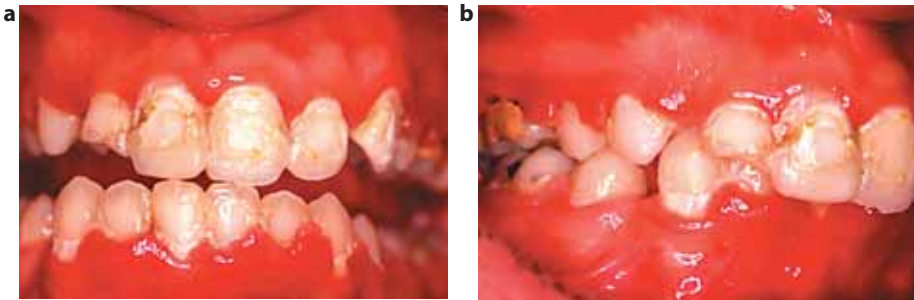
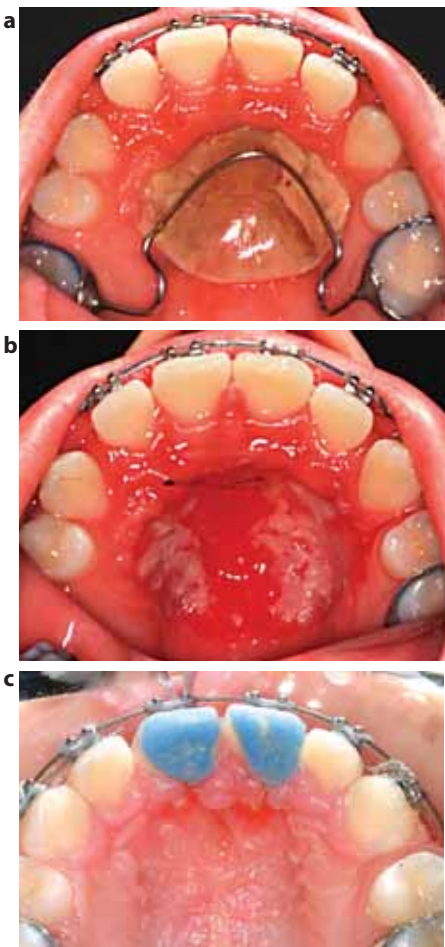


Figure 10. (a–b) Decalcification of teeth which occurred as a result of poor oral hygiene while wearing fixed appliances.



Figure 11. An ulcer on the buccal mucosa associated with an archwire sticking out distal to the tube on the molar band.



Figures 12. (a, b) Infection under a Nance button. **(c)** Nance button that impinged on the palatal mucosa, leading to ulceration.

such patients. Randomized, controlled trials have, however, shown that functional appliances can reliably produce small but favourable skeletal change.^{14,15} On average, the mandible may grow by 1.55 mm longer in patients who undergo twin-block treatment compared to a control group.¹⁴ Treatment with the twin-block therapy, however, produces a substantial reduction in the overjet in patients with Class II Division 1 malocclusions. This reduction in overjet is mainly due to dento-alveolar change (73%) and only a small skeletal change (27%) contributes to this reduction in overjet.¹⁴ However, clinical experience shows that, in patients wearing a twin-block appliance, there is a substantial improvement in their facial profile. In addition, it makes the overall treatment of the malocclusion immeasurably easier by converting Class II molars into Class I and

also reducing the overjet.

In almost every patient who wears a functional appliance, a course of fixed appliances is necessary afterwards to produce a fully interdigitated occlusion.

Fixed appliances

With fixed appliances one can move teeth in all three planes of space. Use of these appliances is, however, not without risks and, sometimes, use of excessive force may result in root resorption and pulp death (Figure 9).

If meticulous oral hygiene is not maintained throughout treatment, unsightly demineralization of enamel may occur¹⁶ (Figure 10).

Molar bands should be checked every visit and these should be re-cemented if they are loose, as dental caries can easily be initiated under these loose bands.

It is not unusual for a patient to come back to the orthodontic clinic with an ulcer in the buccal mucosa (Figure 11). Most of the time these ulcers result from archwires sticking out of the molar tubes. It is recommended to ask patients to check if there is anything sharp in the mouth by moving their tongue, cheeks and lips around their braces before they leave the dental chair. Interestingly, these ulcers are not always painful and the patients should be advised to return immediately if they feel a wire is sticking into their cheek. This happens quite often during the initial levelling and alignment stage, and during the active space closure stage.

Inflamed mucosa is sometimes



Figure 13. (a) A quadhelix embedded in the palatal mucosa. **(b)** A quadhelix has caused palatal root exposure.

seen under a palatal arch with a Nance button (Figure 12a and b). In addition, the inappropriate design or use of a Nance button can result in ulceration of palatal mucosa if there is excessive force during retraction of upper incisors (Figure 12c). Therefore, the Nance button should be made as big as reasonably possible and the anterior limit of the button should not be too close to the lingual surfaces of the upper anterior teeth.

Other rare iatrogenic complications with fixed appliances include quadhelices embedded in the palatal mucosa and inappropriate activation of quadhelix causing root exposure when left in the mouth for extended periods without careful monitoring (Figure 13a and b).

Conclusion

There are many potential hazards which are related to patient, operator and/or the appliance used for the treatment. It is absolutely essential for orthodontists and general dental practitioners to be aware of these limiting factors and these should be explained to the patients before starting the treatment.

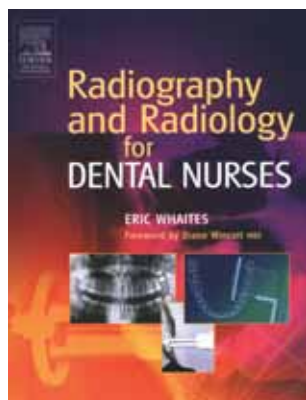
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Book Review

Radiography and Radiology for Dental Nurses. By Eric Whaites. London: Elsevier Church Livingstone (£14.99, 21.95 EUR). ISBN 0-443-102139.

This book has been based on Eric Whaites' *Essentials of Dental Radiography and Radiology*.



It is divided into five sections, containing the core basic information that is essential for Dental Nurses undertaking

a Dental Radiography Certificate, with additional information for interest.

Part 1 is a well laid-out, easy-to-read introduction, discussing the radiographic image, how it is produced and interpreting information on film.

Part 2, *Radiation, Physics and Equipment*, usually a perplexing subject in radiography, has been made easier to understand, with the aid of photographs, diagrams, charts and graphs. This section provides key knowledge required in this aspect of radiography.

Part 3, *Radiation Protection*, discusses all current legislation and guidelines in an easy-to-read bullet point format.

Part 4, *Radiography*, is an ideal section for revision or as a reference. It summarizes the main guidelines for patient

care, importance of cross-infection, including the techniques and positioning of intra- and extra-oral films.

Part 5, *Radiology*, contains lots of diagrams and examples of radiographs. This is a very interesting chapter on assessing image quality, detecting caries and periodontal disease, including a fascinating section on abnormalities and lesions that have characteristic radiographic features.

The book concludes with suggestions for further reading.

Radiography and Radiology for Dental Nurses by Eric Whaites would be an excellent resource for Dental Nurses undertaking the post qualification in Dental Radiography, and also for other professions complementary to dentistry.

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