Orthodontic Diagnosis

A Peer-Reviewed Publication
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Educational Objectives

The overall goal of this article is to provide the reader with information on orthodontic diagnosis. Upon completion of this article, the reader will be able to:

1. List and describe the areas that need to be addressed in the patient interview/consultation
2. List and describe the steps involved in the extraoral examination of patients presenting for orthodontic diagnosis and treatment
3. List and describe the steps involved in the intraoral examination of patients presenting for orthodontic diagnosis and treatment
4. List and describe the types of malocclusions and their genesis

Abstract

Orthodontic diagnosis must be performed thoroughly prior to orthodontic treatment planning. A number of steps are involved in the diagnostic process, all of which must be performed to reach an accurate diagnosis. The overall steps involved include the patient interview/consultation, clinical examination and use of diagnostic records. Only after these steps have been performed and analyzed can a treatment plan be developed for the individual patient.

Introduction

An orthodontic diagnosis must be carried out in a series of logical steps. The combination of three sources of information will lead to a proper orthodontic diagnosis: the patient interview/consultation; the clinical examination by the clinician; and the evaluation of the diagnostic records that include, but may not be limited to, dental casts, radiographs and clinical images. Each of these sources of information is critical to the diagnosis and, ultimately, the patient's orthodontic treatment.[1]

The Patient Interview/Consultation

The three main areas that need to be addressed during the patient interview/consultation appointment are the chief complaint, medical and dental history, and growth potential prediction.

Chief Complaint

The clinician must identify the main reason why the patient is seeking treatment, and this should be noted and documented in the chart *in the patient's own words*. This does not have to be limited to one item only. The list of chief concerns should be established and noted in order of importance to the patient, and nothing should ever be assumed.[1] Some leading questions that will uncover the patient's chief complaint(s) follow: "Do you think you need braces?" and "What don't you like about your smile/teeth/face?" If the patient is attending the appointment with one or both parents/guardians, it is always a good idea to first address the patient and determine his or her chief concern prior to addressing the accompanying party. This will both establish a positive rapport with the patient and let you know whether or not the patient will be compliant with treatment. It is extremely helpful to have a motivated child/adult, since the orthodontic results are directly affected by compliance. Both you and the patient will be more satisfied at the end of treatment if you take the time at the consultation appointment to assess the patient's motivation level and discuss realistic expectations. It is important to know whether the patient recognizes the need for treatment.

Medical and Dental History

A careful and full medical and dental history is necessary to provide a thorough background on the patient's overall health status and to ascertain whether the patient is currently under a physician's care. It is important to discuss any medications the patient may be taking, since some may have an effect on orthodontic treatment. Some examples of conditions and medications that impact orthodontic treatment include uncontrolled diabetes, which can exacerbate periodontal breakdown in response to orthodontic forces, and bisphosphonates, which can result in very slow orthodontic tooth movement. Similarly, chronic use of high-dose prostaglandin inhibitors for management of arthritis in adults may interfere with orthodontic tooth movement.[1] Extractions may be contraindicated in patients with hemophilia, while patients with attention deficit hyperactivity disorder (ADHD) may have less than ideal compliance. In addition, latex allergic patients must be identified and appropriate measures taken to avoid any incidents.[2]

Growth Potential Prediction

The patient (or accompanying adult(s)) should be asked questions about recent changes in clothes/shoe sizes, signs of sexual maturity (achievement of menarche in girls) and age of sexual maturation in older siblings. Look for signs of secondary sexual characteristics, and take note of the patient's height and weight compared to siblings and parents, as this will tell you whether the patient has reached the onset of puberty, is at the peak of his or her growth spurt, or if the growth spurt has ceased altogether. Orthodontic correction can benefit from rapid growth during adolescence, whereas growth modification may not be feasible if a child is over the peak of the growth spurt. Cervical vertebral assessment can be made from the patient's cephalometric X-ray (Fig. 1). It is important to note that one's chronological age does not always coincide with skeletal or dental age. Serial cephalometric X-rays are the best way to determine whether growth has stopped or is still ongoing.[1,3]

Figure 1. Cephalometric X-ray and cervical vertebral assessment
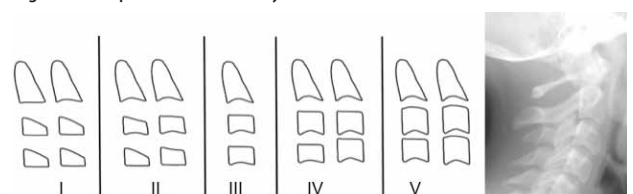
Stage II-III peak growth, Stage V is at least 2 years post peak growth*
*(Angle Orthod. 2002 Aug;72(4):316-23. Baccetti, Franci, McNamara)

Clinical Examination
Extraoral Examination

The facial analysis is conducted with the patient either sitting upright or standing, not reclining in a dental chair. The analysis must consider the frontal plane, facial midlines and lip competency.

Frontal Plane

The proportional relationship between facial height and width is the first step in facial evaluation. The three characteristic categories of facial type are dolichofacial (facial height > facial width, long faces), mesofacial (facial height proportional to width) and brachyfacial (facial width > facial height, square faces). The facial thirds are determined by evaluating the distances from the hairline (trichion) to the prominent ridge between the eyebrows (gl = glabella), the glabella to the bottom of the nose (sn = subnasale), and the bottom of the nose to the chin point (me = menton) (Fig. 2). These distances should be equal. The mouth should be a third of the way between the base of the nose and the chin (Fig. 3). The facial one-fifths are determined by vertical lines going through the helix of the outer ear, the outer canthus of the eye and the inner canthus of the eye. The line through the inner canthus of the eye should pass through the lateral aspect of the alar base of the nose, and all five segments should be one eye distance in width. This can also aid in evaluation of facial symmetry (Fig. 4).[1,4]
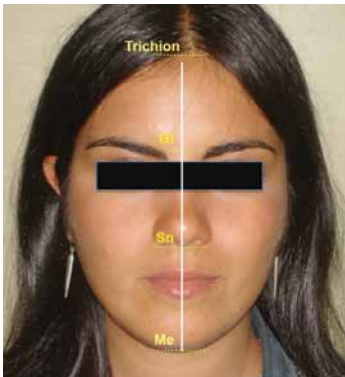
Figure 2. Facial thirds

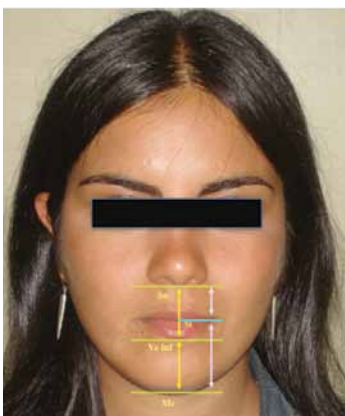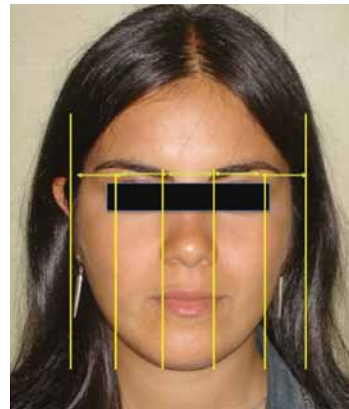Figure 3. Mouth-nose-chin relationship

Figure 4. Evaluation of facial symmetry

Facial Midlines

First and foremost, the presence of any nasal deviation must be identified because this will affect your perception of dental midlines. If a deviation exists, then the midlines should be examined relative to an imaginary straight line (or an actual piece of string held vertical in front of the face) from the soft-tissue glabella. Ideally, this piece of string or imaginary line should pass through the soft-tissue glabella, the philtrum of the upper lip and the soft-tissue chin point. This will aid in determining any asymmetry of the face (Figs. 5, 6, 7).

Figure 5. Relationship of facial to dental midlines before treatment
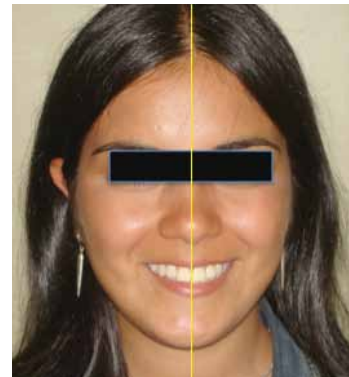
Note: This patient does not show lower midline upon smiling

Figure 6. Relationship of upper to lower dental midlines

Figure 7. Relationship of facial to dental midlines after treatment

Note: If the patient does not show her lower dental midline when smiling naturally, any dental correction in the lower arch will not be visible

Lip Competency

The upper and lower lips should ideally be touching or remain apart up to 3-4 mm while the patient is in a relaxed position (i.e., with no straining of lips or chin to close the mouth). Patients with a short upper lip (short philtrum) tend to "strain" their lips in order to close them and have an interlabial gap of more than 4 mm at rest. Besides indicating a short philtrum, this can also be indicative of protrusive incisors (while jaws are in their normal position), normally inclined teeth but mandibular retrognathism (the mandible being farther back than the maxilla), normally inclined teeth but maxillary prognathism (the maxilla being farther forward than mandible), a combination of both mandibular retroprognathism and maxillary prognathism, or a longer than normal lower face with or without an anterior open bite. In addition to lip strain, these patients can present with a deep mentolabial sulcus and an accompanying hyperactive mentalis. Hyperactive mentalis typically shows up as an "orange peel" appearance of the soft tissue around the chin point (Fig. 8).[1,3,4]

Figure 8. Orange peel appearance

## Smile Analysis, Smiling View and Dental Midlines

Typically, the relationship between maxillary dental midline and facial midline can be determined with this view. If the patient shows lower teeth upon smiling, then the relationship of the maxillary dental midline to the mandibular dental midline, as well as mandibular dental midline to facial midline, can also be determined. Note that any nasal deviations may affect perception of the facial midline. The maxillary dental midline should coincide with the facial midline (see above), and the maxillary and mandibular dental midlines should coincide with each other. Finally, the mandibular dental midline should coincide with the soft-tissue chin point. Deviated chin points may also exist, and this should be taken into consideration (Figs. 5 - 7).

Gingival display can also be noted in this view. Ideally, there should be about 1-2 mm of soft tissue apparent on smiling in this view with 100% of the upper incisor's crown. Document in millimeters the upper incisor visible at rest and when smiling, and the amount of gingivae shown at rest and when smiling. Note that with the aging process, the upper lip will lengthen and the amount of incisor visible will decrease.[4] This can have a definitive effect on what orthodontic treatment plan is eventually undertaken. An above-average gingival display may indicate short clinical crowns (dental), short upper lip/short philtrum (soft tissue) or vertical maxillary excess (skeletal). A below-average gingival display may indicate vertical maxillary deficiency or long philtrum. Recording lip height at the philtrum and the commissures can help clarify the problem.[1]

Buccal corridors (the dark space between the buccal mucosa of the cheeks and the posterior maxillary dentition) should also be evaluated. Obliterated corridors can indicate wide arches. Conversely, excessive corridors can indicate crossbites or transverse jaw discrepancies. At any rate, the width of the dental arches should be related to the width of that individual's face for optimum esthetics. Lay persons can detect this difference and have shown a preference for narrower buccal corridors.[5] The smile arc is basically the contour of the incisal edges of the maxillary incisors relative to the curvature of the lower lip while smiling. If these two lines match each other, the smile arc is called "consonant" (Fig. 9).[4] It has been shown that lay people prefer a consonant smile arc to one that is considered flat.[6] The golden proportion of teeth width when viewed from the front is another aspect of dental appearance to take note of. In an attractive smile, the apparent width of the lateral incisor is 62% of the central and the apparent width of the canine is 62% of the lateral and so on. The width of the maxillary central incisor should ideally be 80% of its height. Obviously, incomplete tooth eruption in children and dental attrition in adults will affect this ratio. In terms of gingival heights, the contour of gingival height of the central incisors and canines should be equal, with this gingival height being about 1.5 mm higher than that of the lateral incisor. The contact points of the maxillary teeth move up gingivally, progressively from central incisor to premolars with the incisal embrasures also getting larger. It is important to inform patients with triangular-shaped incisors that once the teeth are aligned and overlaps cleared, "black triangles" will appear as the contact points move incisally.[1]

Figure 9. Consonant smile arc
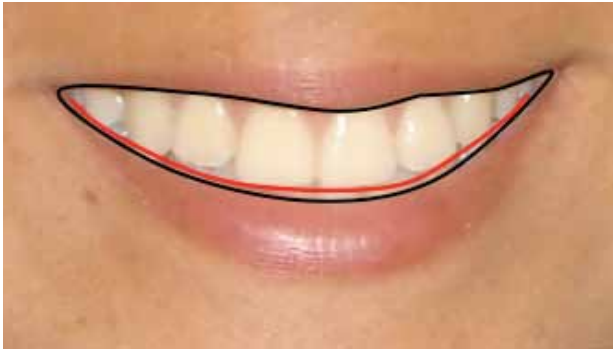
The ¾ View

This view best aids assessment of the relative projections of the upper and lower jaw and gives an impression of the depth of the face. The patient must be positioned at a 45-degree angle. Some features that can be studied in this view are midface deformity, including nasal deformity; prominence of gonial angle; length and definition of the border of the mandible; lip fullness; and vermilion display.[3]

Profile

The same three lines drawn on the frontal plane can be extended to this photograph. Additionally, the Esthetic line of Ricketts (E-line) should be drawn from the tip of the nose to the chin. This helps determine the positions of the upper and lower lip in relation to the E-line. Note that this relationship is directly affected by the size of the nose and chin anteroposteriorly. Patients should be asked to have their lips relaxed when taking this image. Typically, the upper lip should be 4 mm, and the lower lip 2 mm, behind the E-line.[1,3] The prominence of the incisors can affect the patient's profile appearance. Bimaxillary dentoalveolar protrusion explains the situation where the incisors are protruded beyond their normal inclination, while the jaws are in their normal position (Fig. 10).

Figure 10. Bimaxillary dentoalveolar protrusion

Lip strain can also be seen in these cases as the patient struggles to achieve a lip seal (see above). In these patients, retracting the protruded teeth into a normal position improves lip posture. What is interesting to note is that if the incisors are protruded in the absence of lip strain, retraction of the incisors has little effect on lip function or prominence. To establish whether the jaws are proportionally positioned in the anteroposterior plane, a line is drawn on the profile from the bridge of the nose to the base of the upper lip, and another one from that point down to the chin. These two lines should form a straight line. If the angle formed between these is less than 180 degrees, the patient has a convex profile with the chin being behind the bridge of the nose (posterior divergence), while a wider angle indicates a concave profile (anterior divergence). Facial divergence is directly influenced by ethnic background, with American Indians and Asians presenting with anteriorly divergent faces while Northern Europeans typically present with posterior divergence. Vertical facial proportions can also be assessed with the profile image. By placing a finger or an instrument along the lower border of the mandible, the mandibular plane angle (the angle formed by the inclination of the mandibular plane to true horizontal) can be evaluated. Patients with long vertical facial dimensions (dolichofacial) usually have steep mandibular plane angles and a skeletal open bite tendency. Conversely, patients with short vertical facial dimensions (brachyfacial) usually have flat plane angles and deep bite malocclusions.[1]

The nasolabial angle (NLA) is very helpful in determining the final treatment plan customized for the patient. This angle is produced by two lines: one tangential to the columella of the nose (the part of the nose between the base of nose and the nasal tip) and the other tangential to the stomion superius (the highest point on the upper lip). Wherever these two lines meet forms the NLA. This angle relates the upper lip to the columella line. Typically, the measurement in a Caucasian patient is between 90 and 120 degrees. Anything less than 90 degrees is considered an acute NLA and anything greater than 90 degrees an obtuse NLA (Fig. 11).[4]

Figure 11. Nasolabial angle

Intraoral Examination
Oral Health

Ascertain whether the patient is currently under a dentist's care. The patient must have clearance from the general dentist stating that a full clinical examination, including any needed X-rays, has been conducted; that any dental caries has been treated; and that a cleaning as well as fluoride treatment, if needed, has been completed. All teeth must be accounted for to rule out any missing or supernumerary teeth. A thorough examination of the lips, oral mucosa, tongue and floor of the mouth and visual caries detection must be performed for every patient. Any disease or pathology (medical issues, caries, pulpal pathology, periodontal disease, or soft-tissue disease or conditions) must be under control prior to the commencement of orthodontic services. Generalized probing is typically performed to evaluate bleeding on probing, and inadequately attached gingival areas must be noted to avoid treatment that could result in further dehiscence. Any history of prior orthodontic treatment must be explored and will help determine a more precise chief concern of the patient as well as provide insight about the patient's attitude and compliance with orthodontic treatment. Any oral habits such as digit or object sucking, as well as tongue thrust, must be evaluated, as these can be associated with the etiology and have a direct effect on the prognosis of orthodontic treatment (Fig. 12).[1]

Figure 12. Tongue thrust

Occlusion

Mastication, speech and temporomandibular joint disorder (TMD) must be evaluated. Although it is difficult to evaluate masticatory efficiency, some patients report better chewing ability after orthodontic treatment. In children with speech problems, speech therapy in conjunction with orthodontics may help. The most important indicator of joint function is the amount of maximum opening, since restricted opening usually indicates a functional problem.[7] Therefore, any pain and/or click on opening and/or closing, as well as crepitation on movement, must be evaluated and assessed. If the jaws lock on opening and closing, this must be confirmed and followed up on. The muscles of mastication must be palpated as part of the routine examination. Any anterior or lateral shift on closure must be recorded, as it may have an effect on orthodontic diagnosis (true unilateral vs. bilateral crossbites). It is important to determine centric occlusion-centric relation (CO-CR)

shifts (although determining CR in children is not easy, due to undeveloped articular eminences). Detection of a CO-CR discrepancy is needed to rule out "Sunday bites." A Sunday bite can exist in two situations: 1) a patient who shifts his or her mandible forward into a Class I to get closure when there truly exists a Class II mandibular deficiency if he or she were to bite down on the posterior teeth in CO; or 2) a patient who shifts his or her mandible forward into a Class III to get closure but does so in order to bypass an incisor interference when there truly exists an end-on relationship if the patient were to bite down on his or her posterior teeth. This latter condition is also called a Pseudo Class III. Any history of trauma to the face, jaws or teeth must be explored and further followed up on.[1,3]

The patient's overbite and overjet must be determined. Overbite – the vertical distance in millimeters between the incisal edges of the lower incisors and the incisal edges of the upper incisors (Fig. 13) – can be measured using a periodontal probe or ruler. In open-bite cases, the resulting number is negative. Overjet is the horizontal distance in millimeters between the facial surface of the lower anterior teeth and the lingual surface of the upper anterior teeth (Fig. 14). Based on the amount of overlap, you may get different overbite and overjet values, depending on which incisor you do your measurement from. Typically, the largest number is recorded.

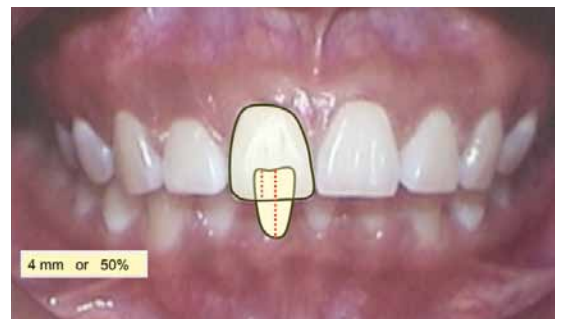Figure 13. Overbite measurement

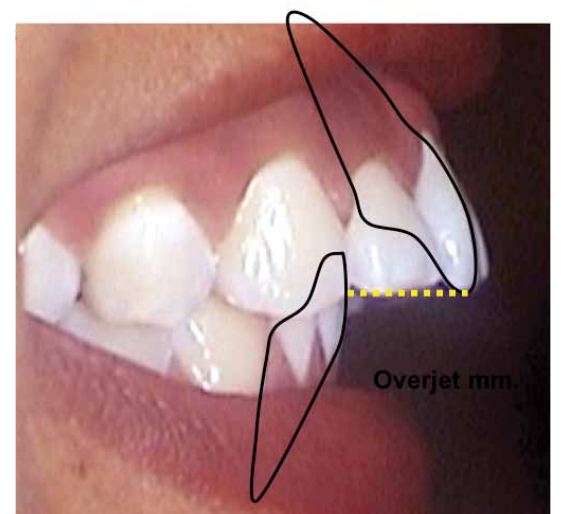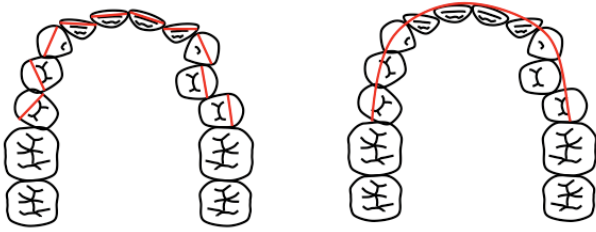

Figure 14. Overjet measurement

Figure 15. Total amount of crowding per arch

The amount of crowding or spacing in each arch must be measured and documented in millimeters. A gauge or intra-oral ruler as well as visual analysis only can be used for this purpose. In crowded cases, each area of overlap between two teeth must be measured in millimeters and added together to give the sum total amount of crowding per arch (Fig. 15).[1]

The presence or absence of a crossbite can be evaluated by bringing the teeth into occlusion. Posterior crossbite explains the position of the upper molars in relation to the lower, and in a bilateral posterior crossbite, both upper molars are lingual to the lower molars. In unilateral crossbite, only one side manifests this problem. A crossbite can be either purely dental or skeletal in nature. A skeletal crossbite exists due to inadequate palatal widths of the maxilla – this can be seen by examining the palatal vault on the casts; if the vault is narrow and maxillary teeth lean out to reach the mandibular teeth, the problem is skeletal. Conversely, a normal-sized vault with tipped molars signifies a dental crossbite (Fig. 16). With teeth in occlusion, vertical problems such as anterior or posterior open bites, and deep bites, can be evaluated. Once again the origin could be dental only or skeletal (for which the cephalometric X-ray needs to be evaluated). A patient with a skeletal open bite will usually have excessive eruption of the posterior teeth but may or may not have an anterior open bite (if the anterior teeth have super-erupted in order to compensate, the patient will not have an anterior open bite). In a skeletal deep-bite patient, the posterior teeth are usually under-erupted and the patient presents with a deep anterior dental bite (Fig. 17).[1,3]
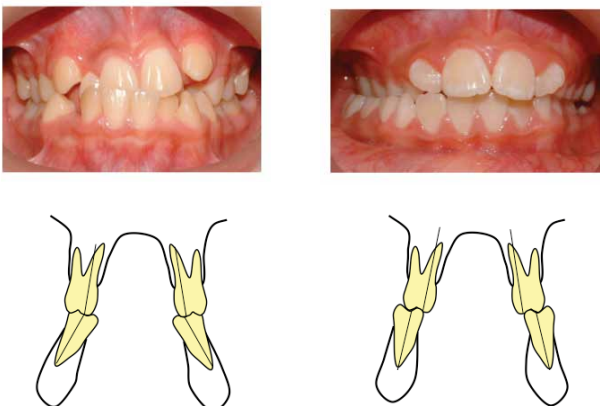
Figure 16. Anterior and posterior crossbites

Figure 17. Skeletal deep bite

Diagnostic Records

It is important to recognize that records are considered an adjunct and are not to be used as a replacement for clinical examination.[8] Cephalograms are usually not required as adjuncts for orthodontic diagnosis and treatment in adults, or for cases involving the correction of minor problems in children. However, if jaw relationships and incisor positions are being changed with treatment, one should definitely consider a cephalogram an integral part of the diagnostic records. Trimmed dental casts (or electronic casts), a panoramic X-ray supplemented with appropriate periapicals and facial form analysis constitute the minimum records needed.[1]

Cast Analysis
Symmetry

A transparent ruled grid is the simplest tool to use to establish symmetry. When it is placed over the maxillary cast and lined up with the midpalatal raphe, any distortion of arch form and shifts of dental units can be determined quickly (Fig. 18).[3]

Figure 18. Establishing symmetry
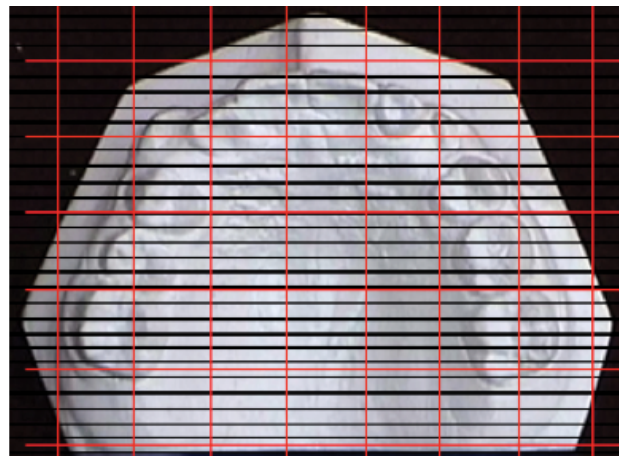
Space Analysis

Space analysis is essentially the difference between "space available" and "space needed." Space available is measured as arch perimeter from the mesial of one first molar in an arch to the opposite first molar in the same arch. There are two ways of doing this – either by measuring the contact point by contact point of each tooth and adding all the numbers or by placing a wire/string on the line of occlusion molar to molar and then measuring its length. Space required is measured by estimating the size of the unerupted permanent teeth and comparing that to the size of the erupted primary teeth. If the space required for the unerupted teeth exceeds that of the erupted teeth or space available, space deficiency exists and crowding is imminent (and vice versa) (Fig. 15). The size of unerupted teeth can be estimated by measuring the teeth on individual periapical radiographs (the enlargement factor of the X-ray must be taken into account) or by using proportionality tables fabricated using data from white American children by Moyers as well as the Tanaka and Johnston table.[1]

Tooth Size Analysis

Also known as the Bolton analysis, this measurement identifies any discrepancy between the sizes of the upper teeth and those of the lower teeth. If the teeth themselves are mismatched in size between the two arches, it is not possible to achieve an ideal occlusion and anterior coupling of the teeth. An anomaly in size of the maxillary lateral incisors is the most common cause of Bolton discrepancy, but variations in the size of premolars or other teeth can also be present. Typically, upper lateral incisors should be larger than lower lateral incisors and all second premolars must be of equal size. Ideally, the sum of the mesiodistal width of the lower six anterior teeth is about 77.2% that of the upper six anterior teeth (anterior Bolton) and the sum of the mesiodistal width of all the lower teeth (excluding second and third molars) is about 91.3% that of the upper teeth (overall Bolton).[9]

Angle's Classification of Malocclusion

Angle's classification is based on the relationship of the first molars and the alignment of the teeth relative to the line of occlusion. Normal occlusion consists of a Class I molar relationship – the mesiobuccal cusp of the upper first molar fits in the buccal groove of the lower first molar, with teeth on the line of occlusion (Fig. 20). A Class I malocclusion–Class I molar relationship consists of crowded and rotated teeth (Fig. 21). In a Class II, division 1 malocclusion, the mesiobuccal groove of the upper molars is mesial to the buccal groove of the lower molars and the anterior teeth are protruded (Fig. 22), while in a Class II, division 2 malocclusion, the upper central incisors are more retroclined than the lateral incisors (Fig. 23). Last, in a Class III malocclusion, the mesiobuccal groove of the upper molars is distal to the buccal groove of the lower molars (Fig. 24).[1,2]

Figure 19. Relationship of first molars and tooth alignment

Class I   Class III

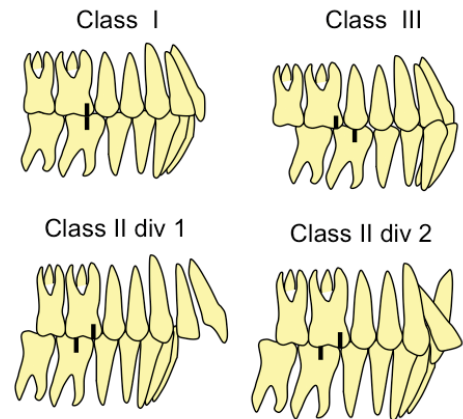Class II div 1   Class II div 2

Figure 20. Normal Class I molar relationship

Figure 21. Class I malocclusion-Class I molar relationship

Figure 22. Class II, div 1 relationship

Figure 23. Class II, div 2 relationship

Figure 24. Class III malocclusion

Cephalometric Analysis

The cephalogram helps with the analysis of the relationship of the major functional components of the face, namely cranial base, jaws and teeth. For every malocclusion, there may exist a dental and a skeletal contributor, and it is possible to have identical dental relationships but very different skeletal discrepancies (the dental cast analysis is incapable of telling the clinician anything about the skeletal relationship of the patient that can be pertinent in the ultimate treatment plan chosen for that case). The Steiner Analysis has been the most widely used cephalometric analysis to date, and while not perfect, it can certainly help the clinician understand the underlying basis for a patient's malocclusion. A Class II or III Angle malocclusion can be the result of a skeletal discrepancy or just a displacement within dental units with ideal jaw relationships; it is also possible to have a combination of jaw discrepancy and dental displacement.[1] It is important to realize that solely comparing individual measurements to a norm is not as important as also looking at the soft-tissue presentation of that patient. Measurements are a means to an end, not an end unto themselves. One other type of cephalogram, a posteroanterior or frontal cephalogram, is used to evaluate whether skeletal asymmetry exists. Although this radiograph is not considered a part of the routine diagnostic radiographs, it is immensely helpful when a facial asymmetry is observed in a patient and an underlying skeletal component is suspected and needs verification (Figs. 25-27).[10]

Figure 25. Orthognathic maxilla, mandible and dental arches

Figure 26. Maxillary dental protrusion, normal maxilla and mandible

Figure 27. Prognathic mandible, protrusive mandibular arch, normal maxilla

Panoramic X-ray

An overview of all the tissues present in a panoramic X-ray should confirm or eliminate the possible presence of any pathology. The sinuses, nasal airways, coronoid and condyle

processes, and hyoid bone area as well as the maxillary and mandibular bone proper must be checked to rule out abnormalities. Any dental pathology such as cysts, traumatic fractures, or abnormal bone pattern or destruction should be evaluated. The number of teeth present must be confirmed and supernumerary or missing teeth accounted for. The location of impacted canines is best viewed in a panoramic radiograph (Fig. 28), and can be backed up with a periapical radiograph (Fig. 29) of that area.[1,3] Lately, even better evaluation has become possible with the use of a Cone Beam CT scan (Fig. 30). Any retained primary teeth and/or congenital absence of the succedaneous teeth can be confirmed using a panoramic radiograph (Fig. 31). Next, the condition of the roots and the presence of periodontal ligament should be noted. The presence of already short roots should instill caution in the clinician. In addition, the status of the wisdom teeth and unerupted second molars must be determined and taken into account in the patient's overall treatment plan.[1] Posterior crowding can be readily viewed on a panoramic radiograph and must be confirmed with additional data from the occlusal casts and intraoral examination.

Figure 28. Panoramic radiograph showing impacted canines
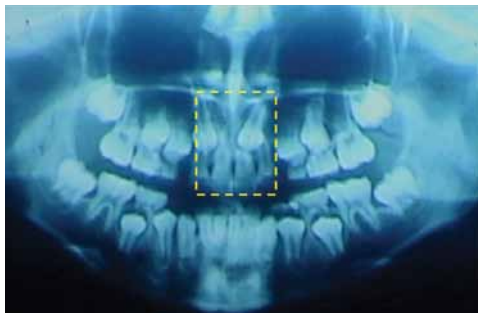
Figure 29. Periapical showing impacted canines

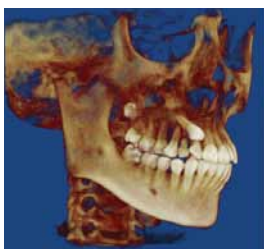Figure 30. Cone beam CT scan

Figure 31. Congenitally missing teeth

Summary

The overall steps involved in orthodontic diagnosis are the patient interview/consultation, clinical examination and use of diagnostic records. All are crucial in the attainment of an accurate diagnosis, which is a prerequisite for successful orthodontic planning and treatment. The automatic compilation of all diagnostic findings helps the clinician create the list of problems present, from which the treatment plan will be developed.

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Questions

1. The three main areas that need to be addressed during the patient interview/consultation appointment are _____.
   a. all complaints, the medical history and the compliance potential prediction
   b. the chief complaint, the medical and dental history, and the compliance potential prediction
   c. the chief complaint, the medical and dental history, and the growth potential prediction
   d. all complaints, the medical and dental history, and the growth potential prediction

2. The main reason why the patient is seeking orthodontic treatment should be noted and documented _____.
   a. in the chart in the clinician's words
   b. in a separate file in the clinician's words
   c. in a separate file in the patient's own words
   d. in the chart in the patient's own words

3. If the patient is attending the appointment with one or both parents/guardians, it is _____ to first address the patient and determine his or her chief concern prior to addressing the accompanying party.
   a. sometimes a good idea
   b. always a good idea
   c. never a good idea
   d. not necessary

4. It is important to know whether _____ recognizes the need for treatment.
   a. the patient himself or herself
   b. the parent or guardian
   c. friends
   d. all of the above

5. _____ can impact orthodontic treatment by resulting in very slow orthodontic movement.
   a. The use of antihistamines
   b. The use of bisphosphonates
   c. Uncontrolled diabetes
   d. all of the above

6. Chronic use of _____ may interfere with orthodontic tooth movement.
   a. high-dose prostaglandins
   b. low-dose prostaglandins
   c. high-dose prostaglandin inhibitors
   d. low-dose prostaglandin inhibitors

7. Chronological age _____.
   a. always coincides with skeletal or dental age
   b. always coincides with skeletal age
   c. always coincides with dental age
   d. does not always coincide with skeletal or dental age

8. Serial _____ are the best way to determine whether growth has stopped or is still ongoing.
   a. periapical X-rays
   b. occlusal X-rays
   c. cephalometric X-rays
   d. panoramic X-rays

9. The facial analysis is conducted with the patient _____.
   a. sitting upright
   b. standing
   c. reclining in a chair
   d. a or b

10. The three characteristic categories of facial type are _____.
    a. dolichofacial, mesofacial and brachyfacial
    b. mesotheliofacial, distofacial and brachyfacial
    c. mesiocclusal, distobuccal and brachyfacial
    d. none of the above

11. The presence of any nasal deviation will _____.
    a. determine the position of dental midlines
    b. affect your perception of dental midlines
    c. determine the amount of medial tooth movement that is required
    d. all of the above

12. An above-average gingival display may indicate _____.
    a. short clinical crowns
    b. short upper lip/short philtrum
    c. vertical maxillary excess
    d. all of the above

13. The width of the maxillary central incisor should ideally be _____ of its height.
    a. 60%
    b. 70%
    c. 88%
    d. 90%

14. The ¾ view _____.
    a. best aids assessment of the relative projections of the upper and lower jaw
    b. must be performed with the patient positioned at a 45-degree angle
    c. gives an impression of the depth of the face
    d. all of the above

15. _____ explains the situation where the incisors are protruded beyond their normal inclination, while the jaws are in their normal position.
    a. Maxillary dentoalveolar protrusion
    b. Maxillary dentoalveolar retrusion
    c. Bimaxillary dentoalveolar protrusion
    d. Bimaxillary dentoalveolar retrusion

16. If the incisors are protruded in the absence of lip strain, retraction of the incisors has _____.
    a. little effect on lip function but a great effect on prominence
    b. a prominent effect on lip function
    c. little effect on lip function or prominence
    d. none of the above

17. American Indians and Asians present with _____ while Northern Europeans typically present with _____.
    a. anteriorly divergent faces; posterior divergence
    b. medially divergent faces; posterior divergence
    c. posteriorly divergent faces; anterior divergence
    d. anteriorly divergent faces; distal divergence

18. Patients who are brachyfacial usually have _____ .
    a. steep plane angles and overjet malocclusions
    b. flat plane angles and overjet malocclusions
    c. flat plane angles and deep bite malocclusions
    d. steep plane angles and deep bite malocclusions

19. _____ can have a direct effect on the prognosis of orthodontic treatment.
    a. Digit sucking
    b. Object sucking
    c. Tongue thrust
    d. all of the above

20. The most important indicator of joint function is the amount of _____.
    a. maximum protrusion
    b. maximum retrusion
    c. maximum opening
    d. maximum overbite

21. In open-bite cases, the overbite number is _____.
    a. greater
    b. positive
    c. negative
    d. none of the above

22. In a bilateral posterior crossbite, both upper molars are _____ to the lower molars.
    a. distal
    b. inferior
    c. lingual
    d. none of the above

23. In a skeletal deep-bite patient, the posterior teeth are usually _____.
    a. over-erupted
    b. under-erupted
    c. early to erupt
    d. late to erupt

24. _____ constitutes the minimum orthodontic record needed.
    a. Dental casts
    b. A panoramic X-ray with appropriate supplemental periapicals
    c. A facial form analysis
    d. all of the above

25. Space required is measured by estimating the size of the _____ and comparing that to the size of the _____.
    a. erupted permanent teeth; unerupted permanent teeth
    b. erupted permanent teeth; erupted primary teeth
    c. unerupted permanent teeth; erupted primary teeth
    d. all of the above

26. The _____ analysis identifies any discrepancy between the sizes of the upper teeth and those of the lower teeth.
    a. Munsell
    b. Morton
    c. Boston
    d. Bolton

27. In a Class I molar relationship, the mesiobuccal cusp of the upper first molar fits in the buccal groove of the _____, with teeth on the line of occlusion.
    a. lower second molar
    b. lower second bicuspid
    c. lower first molar
    d. any of the above

28. The _____ analysis has been the most widely used cephalometric analysis to date.
    a. Stettler
    b. Steiner
    c. Scheiner
    d. Steiger

29. Posterior crowding can be readily viewed on a panoramic radiograph and must be confirmed with additional data from the _____.
    a. occlusal casts and extraoral examination
    b. occlusal casts and intraoral examination
    c. occlusal casts and films
    d. all of the above

30. The overall step involved in orthodontic diagnosis is the _____.
    a. patient interview/consultation
    b. use of diagnostic records
    c. clinical examination
    d. all of the above

Orthodontic Diagnosis

Name: _____ Title: _____ Specialty: _____

Address: _____ E-mail: _____

City: _____ State: _____ ZIP: _____ Country: _____

Telephone: Home (_____) Office (_____) Lic. Renewal Date: _____

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Educational Objectives

1. List and describe the areas that need to be addressed in the patient interview/consultation

2. List and describe the steps involved in the extraoral examination of patients presenting for orthodontic diagnosis and treatment

3. List and describe the steps involved in the intraoral examination of patients presenting for orthodontic diagnosis and treatment

4. List and describe the types of malocclusions and their genesis

Course Evaluation

Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

1. Were the individual course objectives met? Objective #1: Yes No Objective #3: Yes No
   Objective #2: Yes No Objective #4: Yes No

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3. Please rate your personal mastery of the course objectives. 5 4 3 2 1 0

4. How would you rate the objectives and educational methods? 5 4 3 2 1 0

5. How do you rate the author's grasp of the topic? 5 4 3 2 1 0

6. Please rate the instructor's effectiveness. 5 4 3 2 1 0

7. Was the overall administration of the course effective? 5 4 3 2 1 0

8. Do you feel that the references were adequate? Yes No

9. Would you participate in a similar program on a different topic? Yes No

10. If any of the continuing education questions were unclear or ambiguous, please list them.
   _____

11. Was there any subject matter you found confusing? Please describe.
   _____
   _____

12. What additional continuing dental education topics would you like to see?
   _____
   _____

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