

Basic Orthodontic Knowledge for General Practitioners

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ABSTRACT

Awareness of malocclusion and the need for correction for esthetics and confidence is increasing nowadays in population. Patients with malocclusion have no specific signs and symptoms, but may complain about esthetics, maintenance with hygiene and mastication. Thus, pleasing smile is often the major factor which motivates patients to seek orthodontic treatment. Most of the times orthodontic treatment is carried in early permanent dentition, typically at 12 ± 13 years old when the second molars erupt. However, it is important to make an annual assessment in the mixed dentition to identify developing problems and arrange treatment. One of the most harmful misconceptions in dentistry is that orthodontic treatment cannot be started before permanent teeth are fully erupted. Orthodontic screening can be done at any age. The American Association of Orthodontists (AAO) also recommends that every child should be seen by an orthodontist at the first signs of orthodontic problems or no later than age 7. Therefore, it is very important to get basic idea about orthodontic treatment and the time when it is required. This paper describes about orthodontic treatment timing, clinical examination of patient, uses of removable appliances and orthodontic case considerations.

Keywords: Orthodontics knowledge, Malocclusion, Oral habits, Removable appliances, Facial symmetry.

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INTRODUCTION

Pleasing smile is always admired by people.¹ The prevalence of malocclusion is found to vary in different countries, ranging from 20 to 43% in India,^{2,3} and from 20 to 35% in the United States.⁴ The early management of malocclusion is important because of its impact on self-esteem and quality of life.⁵ Early treatment can enable an orthodontist to:

- Monitor and guide jaw growth
- Reduce the risk of trauma to protruded front teeth
- Correct harmful oral habits
- Enhance appearance
- Guide permanent teeth into a more desired positions
- Improve lip closure.

Primary to Mixed Dentition Period

- The most common problems or conditions to look for in the mixed dentitions are: Premature loss of deciduous molars, retained deciduous teeth, submerging molars, impacted first permanent molars, supernumerary teeth,

digit habits, median diastema, first permanent molars of poor prognosis and crossbites.

- It is wise to palpate for permanent maxillary canines in the labial sulcus at the age of 9 ± 10 years; it is widely accepted that early removal of deciduous canines can avoid palatal impaction at a later date.
- At birth: Deciduous incisors and canines half-formed/ deciduous molars initial calcification first molar cusp tips calcified.
- At 9 years: Check position of maxillary canines \pm radiograph, if necessary.
- At 11 years: Leeway space should be looked for premolars eruption. Crossbite should be immediately corrected once seen at this time because at 9 to 10 years roots formation of incisors is in process.
- A general rule of thumb in early 6 months of life, lower incisors are first primary teeth to erupt. The complete set of primary teeth is in the mouth from the age of 2.5 to 3 years of age to 6 to 7 years. Between the ages of 6 and 12, a mixture of both primary teeth and permanent teeth reside in the mouth.
- Girls generally precede boys in tooth eruption.
- Lower teeth usually erupt before upper teeth.
- Primary teeth are smaller in size and whiter in color than permanent teeth.
- The treatment for class III skeletal malocclusion with prognathic mandible should be started as soon as possible in primary dentition^{6,7} with chin cup use.^{4,5}
- The treatment for class II skeletal malocclusion with prognathic maxilla should be started in 7 to 10 years of age with head gear use.^{7,8}

Timely treatment may keep more serious problems from developing and could result in simpler and shorter treatment at a later age. An early orthodontic evaluation gives a child the best opportunity to have a healthy and beautiful smile. Many orthodontic and orthopedic procedures can improve facial growth pattern, eliminate oral habits and avoid extractions of permanent teeth, if it is started at right time.⁹ To do this, a general practitioner should have thorough knowledge to look for and what to do, for example, during normal development when moderate increase in arch width is seen until the permanent cuspid erupts.¹⁰ From this time, a reduction in intercanine width is noted.¹¹ The intermolar width remains stable from 13 to 20 years and there is a reduction in mandibular arch length with time. An increase in lower incisor crowding occurs during the teenage years, a finding which is

more pronounced in females.^{12,13} Although most of the arch changes are seen before age 30, mandibular anterior crowding continues into the fifth decade. Orthodontic appliances bring dentoalveolar changes while orthopedic appliances bring changes in basilar portion of jaws. The orthodontic appliance provided by practitioner is prescribed as retainer which is removable in nature. The following things are to be considered as how to properly insert, remove, activate and take care of removable appliance.

Skeletal and Dental Malocclusion

Skeletal malocclusion should be evaluated by cephalometric analysis via SNA, SNB and ANB findings and Wits appraisal. In moderate-to-severe deep bite cases extractions should be avoided. Similarly severe skeletal open bite cases should be corrected only through surgeries like Le Fort I and not just orthodontically to improve patients profile and smile. Therefore, it is important to differentiate skeletal and dental malocclusion. Also the myofunctional appliance cases should be evaluated by visual treatment objective (VTO) that is if enough of overjet is present and molar relation is class II then bringing mandible forward may improve patients profile. These cases with mandibular deficiency should be best and immediately treated in late mixed or early permanent dentition period instead of unknowingly waiting for all permanent teeth to erupt as misguided by skeletal problem with dental. Similarly class III malocclusion should be treated in early mixed dentition periods to control mandible growth or promote maxillary growth. A patient can be given a short idea of the treatment procedure, complexity and timing of treatment.

Index of Treatment Need

There are five grades according to treatment need. The grade 1 and 2 represent 'slight or no need for treatment', grade 3 represent 'borderline' cases, and grades 4 and 5 represent those in 'great need of orthodontic treatment'.

Peer Assessment Rating

This is used to assess treatment standards. The difference between the scores can be calculated and expressed as a percentage change in peer assessment rating (PAR). A score of 70% and above is considered a high standard and 30% and below makes no appreciable difference. It is important to note that the higher the PAR score at the beginning the more severe the malocclusion, and if we start with a low score it will be difficult to achieve a significant reduction.

CASE HISTORY

Chief complaint should be mentioned in patients words. In majority of cases orthodontic treatment is possible but few

conditions like rheumatic fever or cardiac anomalies require antibiotic coverage for molar bands removal or extractions. Orthodontic treatment can be carried out in juvenile diabetes cases and pregnancy easily if it is a case of nonextraction with good oral hygiene maintained. Skeletal malocclusions especially class III and clefts are inherited.¹⁴ A thorough knowledge of age of eruption and exfoliation of deciduous teeth should be attained. Also the habit, if seen like thumb sucking or tongue thrust, should be mentioned in the history before planning for the treatment. If patient has come for closure of diastema then high frenal attachment should be looked for. If any of the deciduous teeth are not exfoliated or getting delayed then necessary IOPA or OPG are advisable to look for permanent condition. Further patient with skeletal class II malocclusions should be asked for any traumatic injuries to lower jaws either by forceps delivery during pregnancy or accidental or may be due to restricted mandible growth while resting it on pillow while sleeping or resting chin on palm while studying causes deviation of mandible, i.e. facial asymmetry.¹⁵ Sleep disorders are related to severe mandibular deficiencies (obstructive sleep apnea) and enlarged adenoids.

Extraoral Examination

1. Speech difficulties are related to malocclusions. Sibilants (s,z) causes lisping are related with anterior open bites, linguoalveolar stops (t,d) making difficulty in speech is due to malposed incisors while labiodental fricatives (f,v) sounds are to pronounce due to skeletal class III malocclusions, therefore, it is important to recognize the speech problem while looking the malocclusion.
2. Swallowing is never affected by malocclusion.
3. Patient with class II malocclusion trying to bring mandible in forward direction habitually is known as 'Sunday bite' while class III moving mandible forward creating reverse overjet will be known as 'pseudo class III' malocclusion.
4. Evaluation of facial and dental appearance :
 - *Macroesthetics*: Includes jaws excess or deficiency and asymmetry.
 - *Miniesthetics*: Includes upper and lower lips on smile, gums visibility on smile, buccal corridors and amount of anterior teeth display on smile.
 - *Microesthetics*: Includes teeth proportions in height and width, gingival shape and contour, looking for black triangles and teeth shade.

Intraoral Examination

This will include the molar classification, overbite, overjet and dental crowding. This also includes recording the teeth present and their condition, keeping in mind the normal sequence of eruption. The soft tissues will also be observed and the curve of Spee is evaluated. In a super class I occlusion,

the upper first permanent molar is positioned 1.5 mm more distally in relation to the groove of the lower molar as mentioned by Andrew's. Commonly deciduous canine are over retained and for that IOPA or OPG, if required must be taken to look for permanent tooth position and if missing, than further prosthetic replacement is advised instead of unilateral space closure by orthodontic wiring, which might shift the midline and makes profile unpleasant. At the same time high frenal attachment should be checked (blanching test) which is one of the common etiologies for midline diastema. Thumb sucking is persistent up to 4 years of age and tongue thrusting by 8 to 9 years naturally, if not withdrawn they should be checked. Retruded chin and elevated upper lip may also result from lip sucking habit instead of confusing it with skeletal malocclusion. Open bite is another clinical sign that may be related with thumb sucking habit that may also lead to tongue thrust if left untreated. Prolonged lip sucking may lead to open bite in future. Short or hypotonic lip and macroglossia may lead to tongue thrust development (upper lip length by Burstone¹⁶ 23.8 ± 1.5 mm for males and 20.1 ± 1.9 mm for females) and can be corrected by various lip exercises like stretching it in posteroinferior direction and overlapping it with lower lip or holding a piece of paper in between lips for few seconds and repeating as many times as possible in a day. Tongue thrust once detected can be corrected by various elastic swallow exercises and removable appliance with rows of spikes or spur and thumb sucking with proper counseling.

Facial asymmetry affects the lower face more frequently than the upper face. Severt and Proffit reported frequencies of facial laterality of 5, 36 and 74% in the upper, middle and lower thirds of the face.¹⁷ Facial asymmetry may be associated with class I occlusion, but is more frequently associated with class II and III occlusions and may occur by congenitally like by cleft, vascular disorders and hemifacial microstomia or acquired by temporomandibular ankylosis, trauma and fibrous dysplasia or developmental, which is unknown.¹⁸⁻²⁰

Midline symmetry should be evaluated to check whether it is skeletal or dental or of soft tissue. Slight facial asymmetry can be found in normal individuals, even in those with esthetically attractive faces. This minor facial asymmetry is common, usually indiscernible and does not require any treatment. Common causes of dental asymmetry are early loss of deciduous teeth, a congenital missing tooth or teeth and thumb sucking. Skeletal asymmetry may involve one bone, such as the maxilla or mandible, or it may affect a number of skeletal structures on one side of the face, as in hemifacial microsomia. When one side of osseous development is affected, the contralateral side is influenced resulting in compensational or distorted growth. Abnormal muscle function, like masseter hypertrophy contributes to both dental and skeletal asymmetry because of abnormal muscle pull. Fibrosis of the

sternocleidomastoid muscle, as seen in torticollis, may create evident craniofacial deformation if left untreated for a period of time.²¹

By comparing photographs of the right and left sides of a 'normal' face with their respective mirror images, three faces can be visualized; the original face, the two left sides and the two right sides. Often these three faces from the same individual are distinctly different.²² It has been reported that in cases of minor facial asymmetry, the right hemiface is usually wider than the left hemiface with the chin deviated to the left.²³ Clinical examination involves visual inspection of the entire face, comparison of the dental midline with the facial midline, inspection of symmetry between the bilateral gonial angle and mandibular body lower border on OPG, determination of the amount of gingival show per side, and evaluation of malocclusion, occlusal canting, maximal interincisal opening, mandibular deviation and the temporomandibular joint. The presence of a canted occlusal plane could be the result of a unilateral increase in the vertical length of the mandibular ramus and condyle. Clinically, the canted occlusal plane is readily detected by asking the patient to bite on a tongue blade to determine how it relates to the interpupillary plane.

Vertical skeletal asymmetry is also associated with a progressively developing unilateral open bite which may be the result of condylar hyperplasia or neoplasia. Asymmetry in the bucco-lingual relationship, e.g. a unilateral posterior crossbite, should be carefully assessed to determine whether the cause is skeletal, dental or functional.

Treatment of Facial Asymmetry

In preadolescent children it is often difficult with unpredictable results. Growth modification with functional appliances has been problematic and the use of a biteblock rarely prevents the need for other treatment modalities.²⁴ A growing patient with mild asymmetry and a functional condyle should receive early orthodontic treatment and be allowed to finish growth before surgery is undertaken. True dental asymmetry can be managed by orthodontic treatment alone. Asymmetric extraction sequences and asymmetric mechanics can be employed to correct dental arch asymmetry. Prosthodontic restoration may be indicated in pronounced tooth irregularities. Mild functional deviation can be managed by minor occlusal adjustments.

More severe deviations may need orthodontic treatment to align the teeth to obtain proper function. Intentional transverse orthodontic decompensation may also be required sometimes.²⁵ More severe asymmetries require a combination of orthodontic and orthognathic management. Bimaxillary surgery involving a Le Fort I osteotomy and bilateral sagittal

split osteotomy is usually required in the surgical management of facial asymmetry. Orthognathic surgery can be combined within bone contouring, such as a mandibular angle reduction, mandibular inferior border ostectomy, genioplasty and bony augmentation as well as soft tissue contouring, such as buccal fat pad and masseter muscle reduction in the same operation.

Golden Proportionate Rule or Divine Rule

1:1.6 or 1:0.6 explains that ratio of smaller section to larger section is same of larger section to the whole part:

1. A line drawn following the outline formed by the incisal edges of the maxillary teeth should be 1 to 3 mm parallel/equidistant to the lower lip line. Old individuals loose elasticity in the lips which results in sagging. The result is prominence of the mandibular teeth and diminution of the maxillary teeth. A masculine smile is a straight line. A feminine smile forms a curved smile.
2. A line drawn following the gingival contours of the maxillary teeth should follow the line of the upper lip in what is referred to as a medium (average) smile line.
3. In a totally symmetrical face, the upper dental midline and the facial midline should coincide. The mandibular dental midline is then matched with the maxillary midline. Studies have shown that a slight deviation of the midline²⁶⁻²⁸, is not disconcerting to an individual's appearance.
4. The corner of the mouth is considered a dark space as no light enters when standing. A diastema is also a negative space. To control the buccal corridors, three objectives must be achieved:
 - a. Development of an ovoid maxillary arch form.
 - b. Adequate expansion in the premolar and molar regions.
 - c. Mesiobuccal rotation of the maxillary first molars per prescription to fill the buccal corridors with enamel and eliminate the dark spaces.
5. Axial inclination of teeth, anterior and posterior are tilted to the mesial with tight contacts.
6. *Cant of the occlusal plane*: Should be parallel to the upper lip and eyes.
7. When an individual is smiling, the upper lip should be positioned within 2 mm above or below the gingival line.
8. *Gingival line*: The goal is to have the gingival margins of the central incisors and canines at the same level and those of the lateral incisors slightly lower.
9. *Tooth color*: Dunn et al²⁹ found that tooth shade is an important factor in predicting attractiveness. Majority prefer brighter and whiter shade.

Considerations in Periodontal Cases

For periodontal compromise cases it is important to take periodontal status concern first before starting orthodontic

treatment and very mild orthodontic forces can be applied to maintain harmony of tissues. Adolescents have certainly been shown to suffer worse gingivitis than adults during orthodontic treatment.³⁰ Gingival enlargement and inflammation are often transient and resolves within weeks of debonding of braces,³¹ it is therefore always advisable to instruct patient to maintain the hygiene by interdental brushes, use mouthwashes and brush their teeth after every meal and use warm saline gargles on swollen gingival cases.

Considerations in Endodontic Cases

An normally endodontically treated tooth responds normally to the orthodontic treatment. Orthodontic movement of teeth induces some degree of reversible pulpal inflammation. Oppenheim³²(1936) showed some signs of severe degeneration in all human cases using a labiolingual expansion appliance. During rapid tooth movement pulpal injury may occur as described by Seltzer and Bender³³ (1984). Recently Alati et al³⁴ (1996) concluded that acellular cementum was more readily resorbed during orthodontic tooth movement than cellular cementum. Aertun and Urbye³⁵ (1988) tooth with root apex formed are more susceptible to irreversible pulpal changes or necrosis than teeth with incomplete apex formed orthodontic movement.

Considerations in Prosthesis Requiring Cases

A case with orthodontic treatment need and missing or extracted premolars and molar should undergo orthodontic concern first before going for fixed prosthesis as it may become difficult to place braces after prosthesis. At the same time removable prosthesis may be provided to the patient during starting of the orthodontic treatment as it helps in maintaining anchorage, esthetics and functional balance.

Misconceptions in Orthodontic Treatment

The most common treatment failures problems from patients are as follows:

1. *Skeletal problems requiring jaw surgery*: The bimaxillary protrusion cases should be looked for both skeletal and dental prominences. These cases are tried to be compensated by extraction procedure only, which is wrong. Over retraction of teeth to mask skeletal prominence is wrong. Therefore is important to mention about the skeletal problem to the patient which would require surgical correction instead of dental correction alone.
2. *Lower incisor crowding*: Late mandible growth and third molar eruption are main causes of relapse in late teens which should not be confused with none wearing of retention appliance.

Misconceptions in general population like, extraction, might affect eyesight or bone and lead to teeth weakening after the treatment procedure or complete relapse followed by procedure. The myths or doubts of the patient should be cleared from his mind by a general practitioner before starting any procedure. It is also important to tell patient whether the problem is of skeletal or dental proclination or of soft tissue. This should be experienced by cephalometric analysis via digital X-rays preferably. Periodontal status of the patient before starting orthodontic treatment should be evaluated and treated, if required, as early as possible. Some general practitioners think that applying heavy orthodontic forces via removable appliances or fixed appliances can make the treatment faster which is a myth. A force level that is too high may start to damage the bone and surrounding tissues. Too high orthodontic forces may damage the teeth roots, supporting bone and surrounding tissues and unnecessarily prolong the treatment by causing unwanted tooth movement. Even the extractions done for orthodontic procedures are considered as myth that they affect eyesight of the patient. Practical procedure also shows that there is sensitivity problem due to movements of the root in the bone especially in the first molar region which is confused with tooth decay or periodontitis which is generally caused because of movement of roots in bone or periodontal ligament compression. One of the most common believes among general dental practitioner is the retention phase lasts only for 6 months for full time wear. Instead the removable appliance should be checked for its proper fitting and position on anterior teeth and should be gradually discontinued by asking the patient to wear it only in the night time for 2 months at least at 6 to 8 months and reducing it to alternate days again for 2 months and then finally switch off. This should be followed by proper checkup done in regular visits.

Orthodontic appliances can be classified as:

According to CP Adams

- Removable appliances– these are clasped to the teeth and incorporate springs, elastics or screws which store pressure and are removable by the patient.
- Functional appliances– these redirect the pressures exerted by the masticatory muscles or the musculature of the tongue, lips and cheeks and are attached to bands or rings of metal, which are closely adapted and cemented to the teeth.
- Multiband fixed appliances– these make use of flexible archwires and added springs, both of which store pressure.
- Combinations of fixed and removable appliances.

Removable Appliances

Indications of Removable Appliances:

1. Growth modification during mixed dentition.
2. Limited tooth movements like tipping especially for arch expansion or for correction of individual tooth malposition.
3. Retention after comprehensive treatment.

Contraindications of Removable Appliances

1. In mentally retarded patients and periodontal compromised cases.
2. When the cooperation of the patient is doubtful.

Limitations of Removable Appliances

- Only simple malocclusions like mild spacings and crossbites can be corrected.
- Multiple rotations cannot be corrected.
- Root movements cannot be carried out.
- It brings about uncontrolled tipping of teeth if the appliance is not adjusted carefully.
- They can be less easily damaged or can be broken.

Gauges/mm of Wires used

- A 0.5 mm for springs like Z spring and finger spring.
- A 0.7 or 0.8 mm wire for making labial bows (placed in middle one-third of labial surface of incisors), Adams clasp and canine retractors.
- A 0.9 mm for making coffin spring (for expansion), cribs (for tongue thrust habit breaking).

Activation

Active plate are most useful when a few millimeters of space are needed (1.5-2 mm side). If upper appliance has a midline screw for expansion, we may be required to turn the screw once a week. We should not exceed 1 mm per month, i.e. one ¼ turn/week. When you reinsert the appliance, it should feel slightly tighter against the inside surfaces of his teeth.

- Posterior bite plane is necessary to allow clearance for the upper incisor to move out of crossbite (1/2 crown or more is covered) in anterior crossbite cases corrected with expansion plate.
- By dividing the maxillary baseplate into three segments and incorporation of three expansion screws, 3D expansion is possible specially in cleft cases. This design was the basis of Schwartz's original Y plate used to expand the maxillary posterior teeth laterally and the incisors anteriorly. Careful and slow activation can be quite

effective in arch expansion. More than two teeth should be moved by this appliance, for a single tooth spring should be used instead.

Instructions given to Patient after Starting Orthodontic Fixed Appliance Placement

A dentist should instruct the patient to avoid hard and sticky food. In between dentist should call patient for hygiene checkup and look for any breakages of appliance if done.

Instructions for Retainer Wearing after Completion of Orthodontic Fixed Appliance Therapy

- The appliances designed to move teeth must be worn at all times, including periods of sleep. Patient can remove it during meals and asked not to chew gum with the appliance.
- The taste of plastic from, a new appliance, disappears after a day's wear. If the taste is not comfortable than patient can soak appliance in diluted mouthwash for about an hour.
- The acrylic covering palate produces more saliva which may cause difficulties pronouncing certain sounds. A period of 2 to 3 days will be needed to get used to the appliance and talk normally.
- Thoroughly brush and rinse appliance morning and evening.
- Patients with fixed retainers placed should be checked for any breakages of lingual wire placed.
- A dentist also tell the patient about the time period of retainer worn, i.e. at least 6 to 7 months for full time than gradually making it to wear only in night time for 2 months and for every alternate day for 2 months that makes it to almost 1 year wearing and finally stop.

CONCLUSION

Orthodontic problems are generally not associated with high mortality or morbidity; hence, they tend to be overlooked by most health professionals as less important. However, studies indicate that malocclusion has significant impact on the psychosocial health of the affected person. A general dental practitioners have limited knowledge of orthodontics as a specialty and through the discussed matter we can benefit the patient more esthetically and may develop more interest in the specialty and improve our ability. This would benefit the most, especially from the ability to recognize malocclusion and when and where to refer such patients.

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