

Clinical Considerations and Management of Maxillary Anterior Teeth Spacing- A Multidisciplinary Approach

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Abstract

A major objective of dental care is extending the life span of the dentition either by prevention or by treatment of dental diseases. One of the challenges in for dental professionals in their clinics is the management of maxillary anterior spacing. When this spacing is found in adults, periodontal causes, drifting from tooth loss, and habits are added to the genetic reasons that cause spacing to be present. These spacing problems often require a multidiscipline approach between Periodontics, Orthodontics and Restorative Dentistry. Patient's medical and socio-psychological conditions are equally important.

Keywords: Maxillary Anterior Teeth Spacing; Orthodontic Treatment Periodontitis; Pathologic Migration

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Introduction

In the given case (hypothetical), to be discussed various factors need to be considered at all steps of patient management- chief problem of the spacing, the patients age and her physiologic state- all factors would have to be considered to arrive at a diagnosis and planning a line of treatment.

Patient Complaint

A female patient visits dentist with chief complaint that she does not wish to have gaps between her front teeth.

History of Complaint

Firstly what is her main concern related to the problem- impaired dentofacial esthetics that can lead to psychosocial problems, impaired function, and a desire to enhance dentofacial esthetics and thereby the quality of life [1,2]. Since when this problem has been present, did patient notice it by herself or did someone else bring it to her notice, does it affect her normal functioning/ mastication, speech, breathing; are there any other related complaints- tooth ache, bleeding from gums, discharge from the gums; does she recollect normal eruption and shedding of her deciduous teeth, normal eruption of permanent teeth, any history of extractions. All these information are important.

Medical History

The patient should be asked about any medical problems that she is aware of or has been treated for like diabetes, hypertension, malignancy etc. Important to note if patient is on any long term medication of any type, and if so, for what purpose. This may reveal systemic or metabolic problems that the patient did not report in any other way. For example, orthodontic treatment would be possible in a patient with controlled diabetes but would require especially careful monitoring since the periodontal breakdown that could accompany loss of control might be accentuated by orthodontic forces. In adults being treated for arthritis or osteoporosis, high

doses of prostaglandin inhibitors or resorption inhibiting agents may impede orthodontic tooth movement [2].

In this case considering the patient's age history of menopause and any hormone replacement therapy that she is on should also be noted. Oral changes in menopause include thinning of the oral mucosa, oral discomfort ("burning mouth"), gingival recession, xerostomia, altered taste sensation, alveolar bone loss, and alveolar ridge resorption. Osteopenia and osteoporosis have been associated with the menopausal patient [2].

Dental History

Dental history is important to know if the patient regularly visits a dentist and cares for her teeth. Also gives an idea of any active disease condition or habit that the patient is aware of. Frequently asked questions are: How many cavities and fillings have been done? Any prosthesis that she is wearing and if so since how long? Reasons for the same? Presently does he/ she have toothache or sensitivity? Do the gums bleed on brushing? Any clicking or pain on opening and closing the mouth? Any oral habits? Any facial injury? Has she faced any complication during previous dental treatment? If yes, explain [2].

Family History

A detailed information about the medical and dental history of any family members like parents or siblings would also be helpful as certain conditions show specific inheritance pattern.

Social and Behavioral Evaluation

Should evaluate various interrelated areas: the patient's motivation for treatment, what she expects as a result of treatment, and how cooperative or uncooperative the patient is likely to be. Motivation for treatment could be external (supplied by pressure from another individual) or internal (comes from within the individual based on her assessment of the situation and desire for treatment. What the patient expects from the treatment and how much she is willing to cooperate is very much related to the type of motivation and should be explored carefully with adults, especially those with primarily cosmetic problems for if she expects social adjustment problems

to be solved after the teeth are straight she may be a poor risk for treatment [2].

Examination

Extra Oral Examination

Evaluation of jaw and occlusal function: 3 aspects of function require evaluation: mastication (including but not limited to swallowing), speech, and the presence or absence of temporomandibular joint problems. Patients with severe malocclusion often have difficulty in normal mastication, and may have problems with lip and cheek biting during mastication [2].

Evaluation of facial and dental appearance: should be done in 3 steps: (1) the face on all 3 planes of space, (2) the smile framework, and, (3) the teeth. In this case special attention should be paid to the jaw relationship in the anteroposterior plane and lip position and incisor prominence. Like presence of class II malocclusion or lip incompetence with severe incisor prominence. Also the tooth-lip relationship should be noted for the midline and lip position/ incisor display at rest and while smiling. Tooth proportion should be noted for tooth widths in relation to one another and the height/width proportion of individual teeth. This will give an idea of tooth size and jaw size [2].

Intraoral Examination

The health of oral soft and hard tissues must be assessed including medical problems, dental caries or pulpal pathology, and periodontal disease. Count the number of teeth making note of any missing or supernumerary tooth. In periodontal examination see for indications of active periodontal disease and potential or actual mucogingival problems [2].

The caries and periodontal status should be noted in detail in the indices charts used in the clinic. All surfaces of the crowns and roots should be examined for caries, fractures, perio-endo lesions, food packing, diastemas, subgingival calculus, pocket depths measured and noted, tooth mobility, any fillings, crows or prosthesis and their condition-over hangings, faulty margins, poorly contoured restorations should also be made a note of. The intercusp relations of the teeth especially the anterior should be examined and noted- deep bite, over jet,

contacts, guidance etc. at rest and during movement. Any abnormal tooth wear say due to attrition or erosion, interproximal, wear fractured teeth or restorations should also be examined and noted.

The health of the mucosa could be an indicator of underlying systemic condition. Also the tongue size and presence of teeth marks along the anterior and lateral borders should be noted, indicating macroglossia or tongue thrusting. Other destructive habits and self inflicted injuries should also be looked for. The frenal bulk and attachment should also be noted for any abnormality say high frenal attachment or fibrous bulky frenum.

The skeletal pattern and the molar relation should be noted and any malocclusion if any should be mentioned in the patient chart. The occlusion and guidance should be noted at rest, intercuspation and during lateral and forward excursions.

Provisional Diagnosis

Soft Tissue Causes

1. Cyst or tumor
2. Abnormal frenal attachment – midline diastemas

Hard Tissue Causes

1. Supernumerary teeth
2. Narrower than normal maxillary anterior teeth results in spacing, often bilaterally symmetrical.
3. Skeletal deep overbite.
4. Pathologic migration results from alterations in the intensity, duration and direction of forces on the tooth.
5. Para functional habits
6. Periodontal inflammation and attachment loss.
7. Tooth fracture
8. Malocclusion
9. Erosion

In the beginning we need to say that some spacing has its origin in developmental difficulties unrelated to periodontal disease influences. First, Microdontia –teeth which are smaller

than normal. One of three types may be present - True, relative and microdontia involving single tooth [3].

True generalized –all teeth are smaller than normal. Narrower than normal maxillary anterior teeth results in spacing, often bilaterally symmetrical. To determine whether your clinical observation of spacing is related to tooth size inadequacy, take the widths of the lower 6 anteriors and multiply their total width by 1.3. The resulting number should be the width of the six maxillary anteriors.

Relative generalized –normal size teeth present in somewhat larger than normal jaw.

Involving single tooth- most common in maxillary lateral incisor which may be congenitally missing or peg shaped

Peg lateral – cone shaped crown with converging mesial and distal surfaces incisally.

A second non-periodontal related adult deformity which can produce spacing is skeletal deep overbite. The clinical findings to look for are lower incisors which are significantly coronal to the plane of the posterior mandible, producing a bowed occlusal line when the occlusal plane is viewed from a lateral perspective. Deep overbite of skeletal origin needs to be distinguished from deep overbites resulting from posterior bite collapse or lower anterior supraeruption. One of the best confirmations of the skeletal deep overbite comes from observing the alveolar process surrounding the lower anterior teeth and its relationship to the upper anterior teeth. When the incisal edge of the upper anterior teeth covers the free gingival margin of the lower incisors, skeletal causes are likely. With the patient in occlusion it should be evident that the lower incisors approach the palatal gingiva and the maxillary incisors are laterally or facially displaced without much supraeruption [2].

Once skeletal considerations have been addressed, the periodontal and occlusal origins of anterior spacing remain. They are discussed below:

a. Pathologic Migration of Teeth

Alterations in a tooth position should be carefully noted, particularly with a view toward identifying abnormal forces, a tongue-thrusting habit, or other habits that may be contributing

factors. Premature tooth contacts in the posterior region that deflect the mandible anteriorly contribute to the destruction of the periodontium of the maxillary anterior teeth and to pathologic migration [4, 5].

Two major factors play a role in maintaining the normal position of teeth: the health and normal height of the periodontium and the forces exerted on the teeth. The latter includes the forces of occlusion and pressure from the lips, cheeks and tongue. The following factors are important in relation to the forces of occlusion: tooth morphologic features and cuspal inclination; the presence of a full complement of teeth; a physiologic tendency toward mesial migration; the nature and location of contact point relationships; proximal, incisal, and occlusal attrition; and the axial inclination of teeth. Alterations in any of these factors start an interrelated sequence of changes in the environment of a single tooth or group of teeth that results in pathologic migration. Thus pathologic migration occurs under conditions that weaken the periodontal support, increase or modify the forces exerted on the teeth or both. Pathologic migration is also an early sign of localized aggressive periodontitis [4, 5].

It is important to understand that the abnormality in pathologic migration rests with the weakened periodontium. The force itself need not be abnormal. Changes in the magnitude, direction, or frequency of the forces exerted on the teeth can induce pathologic migration of a tooth or a group of teeth. Also changes in the forces may occur as a result of unreplaced missing teeth, failure to replace first molars and other causes [4, 5].

b. Posterior Bite Collapse/Failure to replace 1st molars

Drifting usually occurs in a mesial direction, combined with tilting or extrusion beyond the occlusal plane. Premolars frequently drift distally. One or more clinical findings will be present:

1. The 2nd and 3rd molars tilt, resulting in a decrease in vertical dimension.
2. The premolars move distally, and the mandibular incisors tilt or drift lingually. While drifting distally the

mandibular premolars lose their intercuspal relationship with the maxillary teeth and may tilt distally.

3. Anterior overbite is increased. The mandibular incisors strike the maxillary incisors near the gingiva or traumatize the gingiva.
4. The maxillary incisors are pushed labially and laterally.
5. The anterior teeth extrude because the incisal apposition has largely disappeared.
6. Diastemas are created by the separation of anterior teeth.

c. Occlusal Disharmonies

Occlusal disharmonies caused by the altered tooth positions traumatize the supporting tissues of the periodontium and aggravate the destruction caused by inflammation [4, 5, 6]. The following are signs that may help discover destructive occlusal habit patterns [7]:

1. Loss of enamel contour especially on the incisal edges of anterior teeth.
2. A change in smile line over the years.
3. Changes in vertical dimension showing facial collapse.
4. Wear facets that are destroying the natural esthetic contour of the teeth especially canine.
5. Newly apparent spaces in the mouth or the enlargement of previously existing spaces.
6. Newly flared erupted or submerged teeth.
7. Ridges, lumps or masses in the tissue of the tongue, lips or inside the mouth.

d. Pathologic Migration

Although pathologic migration can result from pipe chewing, nail biting and other dysfunctional uses of the teeth, the major parafunctional habit patterns include bruxing and clenching. Severe wear occurs from a centric occlusion position well onto the cusp tips in lateral excursion. When clenching is evident, we often see mobility as well with tooth contacts opening. Clenching forces appear to be repetitive and more focused in specific areas of the ligament space. When combined with periodontal attachment loss, migration is likely to result.

Open contacts with distal drifting of second molars should alert the clinician to closely scrutinize the periodontal and occlusal status of the teeth adjoining the space.

e. Periodontal Inflammation and Attachment Loss

As periodontal disease begins, the normally tightly adapted gingival tissues lose their tonicity and swelling produces a continuous light load on the tooth surface. With loss of the attachment apparatus and increased area of inflammatory change the tooth migrates away from the pocket, except for facial pocketing where occlusal forces will collapse the tooth into the defect area and accelerated labial tilting and mandibular supraeruption will result. Once the supraeruption process begins, treatment rapidly becomes complex as intrusion or incisal reduction become necessary to allow room for repositioning the now malposed anterior teeth.

In advanced cases of periodontal disease, pathologic migration is usually a combination of the above conditions:-

- Degree of gingival recession. During periodontal examination, it is necessary to record the data regarding the amount of gingival recession. This measurement is taken with a periodontal probe from the cemento-enamel junction to the gingival crest [4, 5].
- Alveolar bone loss. Alveolar bone levels are evaluated by clinical and radiographic examination. Probing is helpful for determining (1) the height and contour of the facial and lingual bones obscured on the radiograph by the dense roots and (2) the architecture of the interdental bone [4, 5, 6].

f. Tooth Mobility

Mobility beyond the physiologic range is termed abnormal or pathologic. It may be caused by one or more of the following factors [4, 5, 6]:

1. Loss of tooth support (bone loss)
2. Trauma from occlusion- may be due to excessive occlusal forces or abnormal occlusal habits like bruxism or clenching, or even hypo function.
3. Extension of inflammation from the gingival or from the periapex into the periodontal ligament

4. Periodontal surgery temporarily increases mobility.
5. Increased in pregnancy and sometimes associated with the menstrual cycle or the use of hormonal contraceptives.
6. Pathologic processes of the jaws that destroy the alveolar bone and/or the roots of the teeth (osteomyelitis and tumors of the jaw).

g. Trauma from Occlusion

Periodontal findings that suggest the presence of this include excessive tooth mobility, particularly in teeth showing radiographic evidence of a widened periodontal space; vertical or angular bone destruction; infrabony pockets; and pathologic migration, especially of the anterior teeth [4, 5, 6].

h. Pathologies

Any other intraosseous pathology should also be considered and the alveolar bone should be examined and palpated to feel for any bony or cystic pathology. Large periapical cysts or bone tumors can cause root resorption and increase tooth mobility and cause drifting of teeth. Also abnormal frenal attachment could be a cause of anterior spacing [3]. Blanch test to diagnose fleshy labial frenum. Presence of notch in inter-dental alveolar bone as seen in radiograph.

Investigations

Tooth vitality needs to be tested for all the involved teeth to know incidental loss of vitality, ensure endodontic treatment is not required and that unsuspected loss of vitality does not compromise subsequent treatment plan [9].

Diagnostic records

The panoramic image has two significant advantages over a series of intraoral radiographs: it yields a broader view and thus is more likely to show any pathologic lesions and supernumerary or impacted teeth, and the radiation exposure is much lower [2, 9].

But for adults diagnostic radiographs should include individual intraoral radiographs to supplement the panoramic film to obtain sufficient detail of active dental disease if present [2, 9].

Articulator mounted casts are needed to assess occlusion and produce a diagnosis wax up if required, also to

facilitate the planning of associated restorative procedures [2, 7, 9].

Treatment

Line of treatment would depend on the diagnosis made. Firstly patient needs to be educated about the problem and the line of treatment selected. Instructions in plaque control, tooth brushing and interdental cleaning need to be given and reinforced at every visit. Narrower than normal maxillary anterior teeth: This condition is resolved best by fixed orthodontics to equalize the spaces across the maxillary anterior segment followed by restorations to enlarge the undersized teeth. Narrower than normal maxillary anterior teeth must be retained as is or treated as noted above.

Some recommended methods for space closure are [8]:

- Direct composite resin veneers
- Indirect composite resin veneers
- Ceramometal- full coverage restorations
- All-porcelain restorations
- Porcelain laminate veneers
- Orthodontic therapy

Replacement with prosthesis for the spaces that is too large to be corrected with tooth build up materials like due to missing, extracted or impacted teeth. These could be by removable acrylic denture, removable prosthesis with chrome-cobalt framework, bridge, implants.

For Periodontal inflammation and attachment loss subgingival scaling and root planning needs to be carried out after supragingival scaling. Restorative correction is possible when migration has limited proximal contact separation to less than two millimeters, within the ability of the clinician to maintain esthetic tooth proportions while closing the spaces. In the same way, pathologic migration which elongates the upper anterior tooth to a point where it cannot be shortened to the occlusal plane (or adjoining teeth elongated) without compromising esthetics or phonetics must be treated orthodontically to be retained [9].

Periodontal treatment is central to determining the long-term stabilization required for effective treatment. Also check for-

- Extractions of any teeth with severe periodontal bone loss which cannot be saved.
- Skeletal deep overbite: Orthodontic/orthognathic consultation should be sought for these cases following screening for periodontal disease.
- Frenectomy –complete removal of frenum including its attachment underlying bone. Space can be closed by composite restoration, using finger springs, fixed orthodontics. Disadvantage is high chances of relapse.⁴
- Pathologic conditions of the jaws: depending on the type need to be treated at the earliest possible. If required the patient should be referred to an oral and maxillofacial surgeon for required treatment.

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