Case Report:

Mesial Migration of the Maxillary Buccal Segments

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Mesial migration of the maxillary buccal segments is characterized by the occlusal inclined plane relationship of these teeth being mesial of their normal position the width of a premolar. The result is either malerupted canines, (completely or partially blocked out) with the incisal segment in good position, or a maxillary denture in protrusion. The following case has both characteristics to some degree with a mandible in normal relation to cranial anatomy. Correction of this type of malocclusion, in order to obtain good facial esthetics and stability, can only be attained by the extraction of two maxillary teeth, preferably the first premolars.

History of Patient

C. M., a girl, age sixteen, in good health. Normal delivery and usual childhood diseases, tonsils and adenoids removed at an early age. There had been premature loss of several deciduous teeth and removal of both lower first permanent molars because of caries. Although this was a definite etiologic factor, there was one sister who had the same type of deformity so that the assumption of an inherent genetic pattern could be made.

Examination of X-rays and Photographs

The x-ray examination revealed caries, a badly broken down upper right lateral incisor with a large radiolucent area about its apex and the presence of second molars in the area usually occupied by the mandibular first molars. Mandibular third molar buds were missing and the maxillary third molar buds were present.

The photograph of the left profile before treatment (Fig. 1) revealed a face with good relationship of the mandible to cranial anatomy and a

Fig. 1. Profile before treatment (left) and after treatment (right).

lack of maxillary developmental growth.

ORTHODONTIC EXAMINATION

In the examination of models before treatment (Figs 2, 3 & 4) the molar relationship was Angle Class II. The maxillary arch was slightly underdeveloped. The upper incisor segment had the central incisors in labial version; the lateral incisors were in good relationship to alveolar process, the maxilla and the lower denture although they were blocked out by the mesial drifting of the buccal segments.

The mandibular arch was well developed but with the second molars occupying the position of the first molars that had been lost; the incisor segment was crowded and its dental units rotated and in lingual axial inclination. It was evident that both buccal segments of the maxillary arch were located mesially to their proper position in the dental arches.

DIAGNOSIS

The above findings led to a classification of Angle Class I malocclusion with a mandible in good relationship to cranial anatomy and the mandibular denture in good relationship to its alveolar process and mandible. The maxillary buccal segments were anterior to their proper position in their dental arches. The maxillary central incisors were in labial version. The two maxillary lateral incisors were the only dental units in this arch in their proper maxillo-dental-alveolar-mandibular relationship. The condition may be described as a maxillary bilateral mesial drifting of the buccal segments resulting in protrusion of the central incisors and the blocking out of the laterals so that they appeared to be in lingual version.

TREATMENT

Treatment required the distal bodily movement of both maxillary buccal segments and maintenance of the mandible with its super-imposed denture in its present position in order to obtain ideal occlusion for this patient. As noted in the diagnosis, this is a Class I Angle malocclusion. Expansion of the maxillary dental arch and moving the mandible forward was contra-indicated and would court failure in the possible creation of a dual bite and/or an orthodontically created bimaxillary protusion. That would have substituted one type of malocclusion for another: an unstable maxillary denture that must relapse with the crowns of all the teeth in labial and buccal relationship to their supporting alveolar bone and jaws and surrounding muscular tissue. The distal movement of the buccal segments in this case was both impossible and inadvisable.

The conclusion was drawn that there existed in the maxillary denture a discrepancy of tooth material to supporting bone that could only be corrected by a reduction in tooth material. The arch length from mesial of first molar on one side to the mesial of the first molar on the opposite side in both jaws does not increase in length after approximately eight years of age and orthodontic therapy will not make its supporting jaw in this area any longer. Increasing dental or dento-alveolar arch length or arch width does not increase jaw width or length, or influence the surrounding musculature; it is the surrounding musculature that maintains and influences the denture and its supporting jaw bones. It is of great importance to remember that the alveolar process belongs to the teeth and not to the jaws.

The desired objectives in treatment were: 1. a stable denture in balance with the jaws and supporting and surrounding tissues; 2. a facial balance and harmony; 3. these objectives to be obtained with the least amount of trauma and tissue damage. This could be done with the reduction of tooth material in the maxillary denture equivalent to its

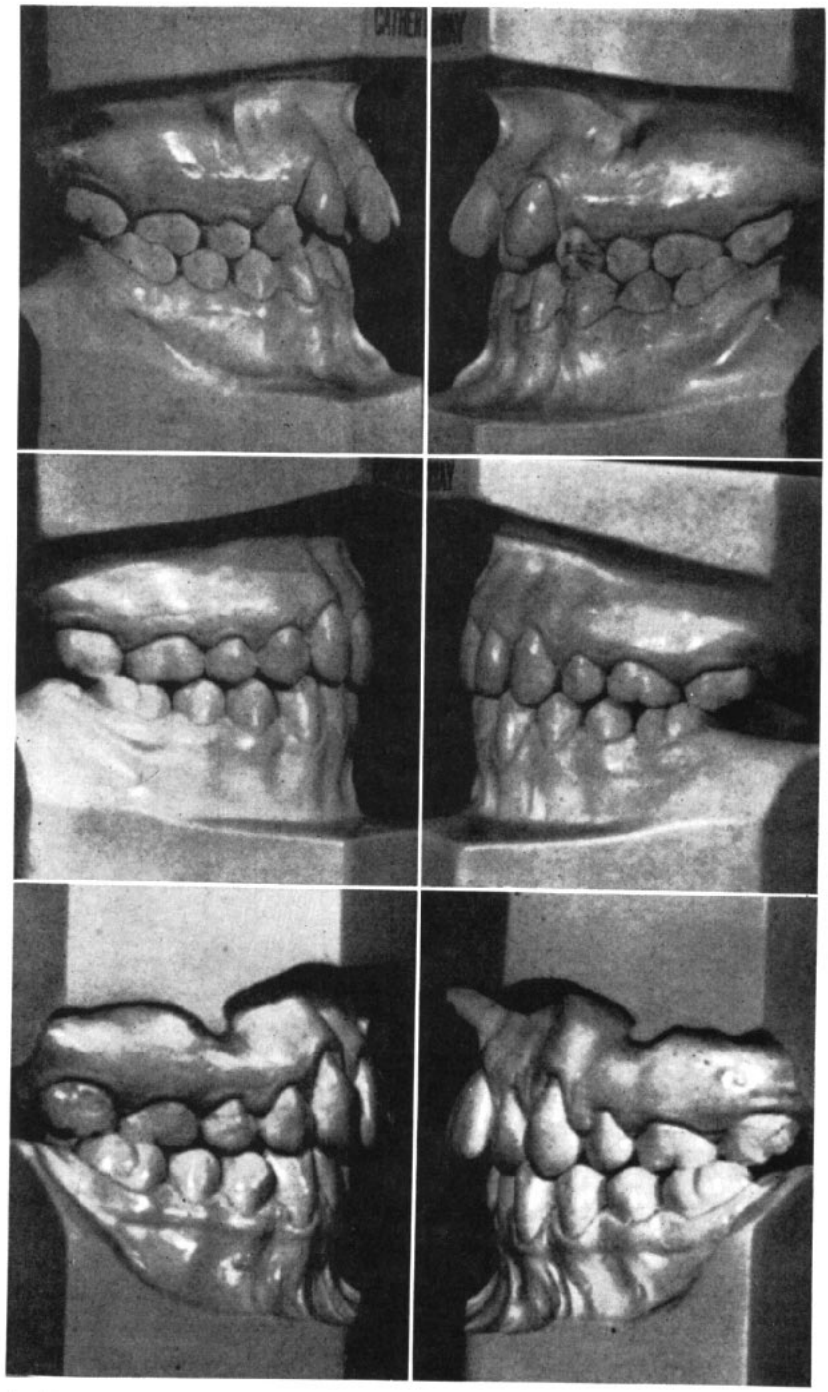

Fig. 2. *Top row*: before treatment; *Middle row*: after treatment; *Lower row*: final analysis three years after end of retention.

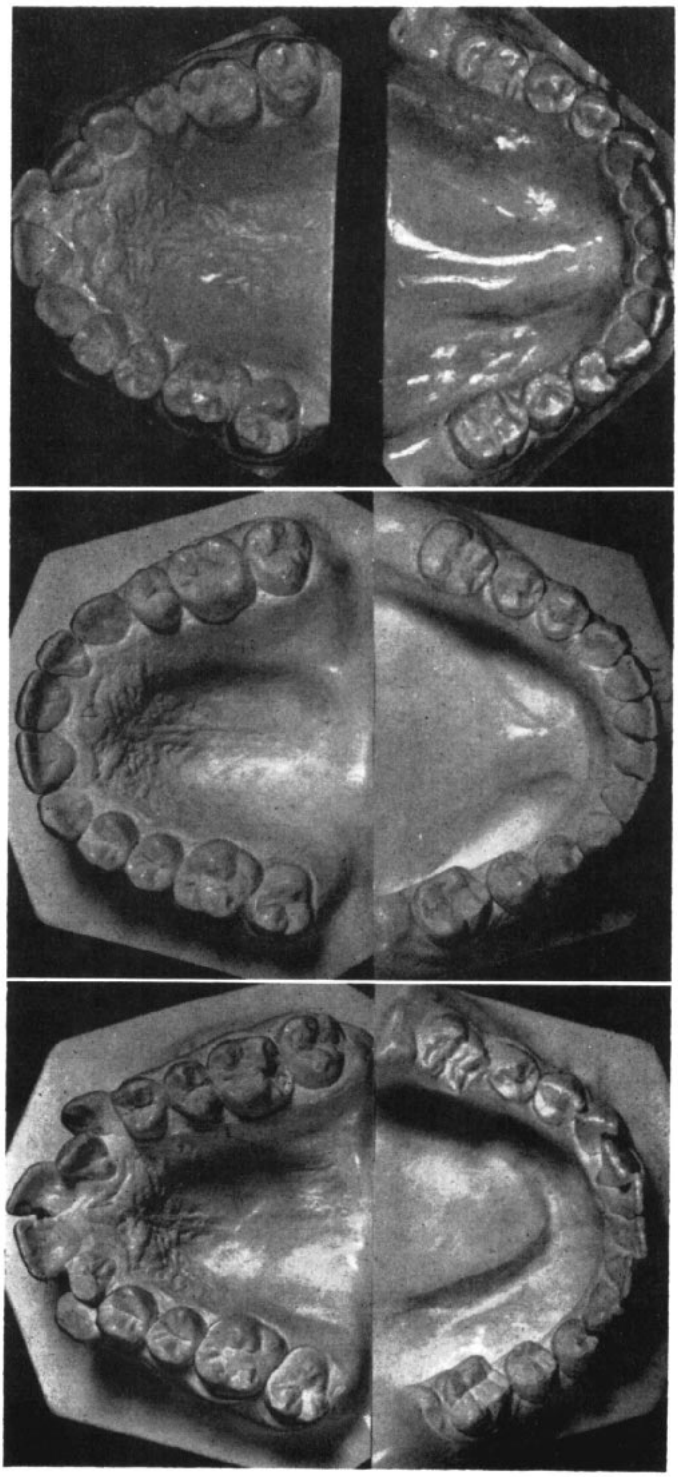

Fig. 3. *Left*, before; *middle*, after; *right*, final analysis.

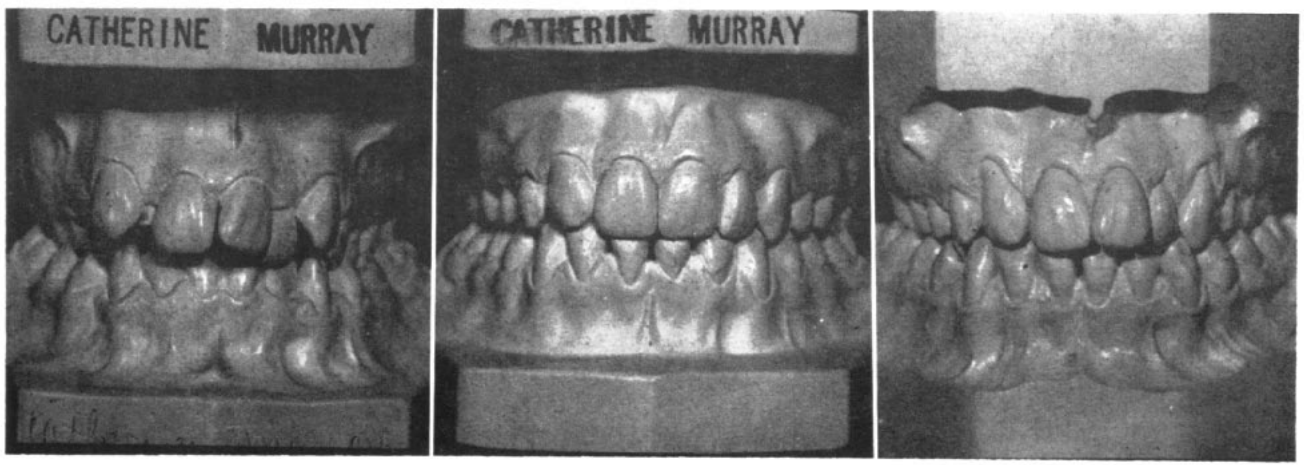

Fig. 4. *Left,* before; *middle,* after; *right* final analysis.

supporting bony base.

The mandible had the two first molars missing. In order to achieve the desired result, the two maxillary first premolars should be removed. Due to the diseased condition of the upper right lateral incisor, it was decided to remove it and the upper left first premolar.

The treatment plan in the maxillary denture was to move the upper right canine into the position occupied by the right lateral incisor, the upper left canine into the position occupied by the upper left first premolar, the central incisors lingually and to correct midline discrepancy. All this to be accomplished without the mesial movement of the buccal segments. Proper alignment of the dental arch, correct axial inclinations, rotations and proper proximal contacting of all dental units were also planned.

In the mandibular denture the aim was to gain proper arch alignment, to correct rotations, axial inclinations and proximal contacting of all dental units and to maintain the denture in basal bone and in proper relationship to its surrounding and supporting tissue.

MECHANO-THERAPY

The appliance utilized was the edgewise arch. Anchor bands were placed on the second molars in the maxilla and on the last molars in the mandible with buccal tubes having a lumen .023" x .029". All the remaining teeth were banded with edgewise tie brackets carrying mesial and distal staples.

Maxillary denture: A .016" round arch wire was inserted to get bracket engagement of the maxillary dental units, with the exception of the lateral incisor. This was followed at two week intervals with .018" and .020" round arch wires until a .021" x .025" rectangular arch wire was inserted with a coil spring mesial to the upper left canine bracket and a sliding hook mesial to the coil spring, permitting an intra-maxillary elastic from the distal of the upper left second molar to engage the sliding hook, thus activating the coil spring for the distal movement of the upper left canine. Slight distal tipback bends were incorporated in the left buccal segment to counter-act the undesirable mesial pull of the elastic force (Figure 5).

A, Action of tip back bends-distal crown and mesial root tipping
B, Intra maxillary elastic exerting mesial and distal forces for distal movement of canine by action of compression of coil spring
C, Coil spring
D, Sliding hook
E. Staples ties to arch wire to prevent distal rotation and tipping of canine and mesial rotation and tipping of second premolar

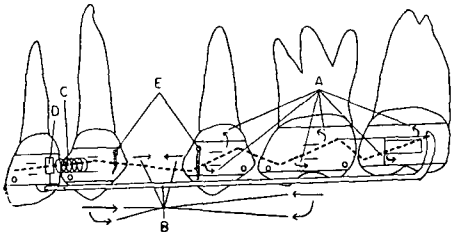

Fig. 5. Diagram of mechanics used to retract maxillary left canine tooth.

As will be noted in the illustration, the action of the tip back bends in this buccal segment was a distal crown and mesial root tipping to counter-act the mesial crown and distal root tipping action of the reciprocal mesial pull of the intra-maxillary elastic. The distal force of the elastic on the compressed coil spring acting on the canine in pushing it distally into the space previously occupied by the first premolar had a tendency to tip this tooth distally. In order to prevent this and obtain a bodily distal movement of this tooth, the relationship of the arch wire to the bracket of this canine was one that exerted a slight mesial crown and distal root movement of this tooth. At the same time the distal staple was soldered gingivally on this band so that when it was tied to the arch wire, it prevented the distal tipping of this tooth. This was a very important factor in avoiding a 'V' between the canine and second pre-

molar. Such axial inclination would permit opening of the contact point of these teeth as they tended to upright after retention. The staple on the second premolar was also soldered mesiogingivally to aid the distal tip bend in preventing this tooth from tipping mesially.

Examination of the x-rays before and after treatment indicates that the objective for bodily distal movement of the canine was successfully accomplished and without mesial tipping of the second premolar and first molar (Fig. 6).

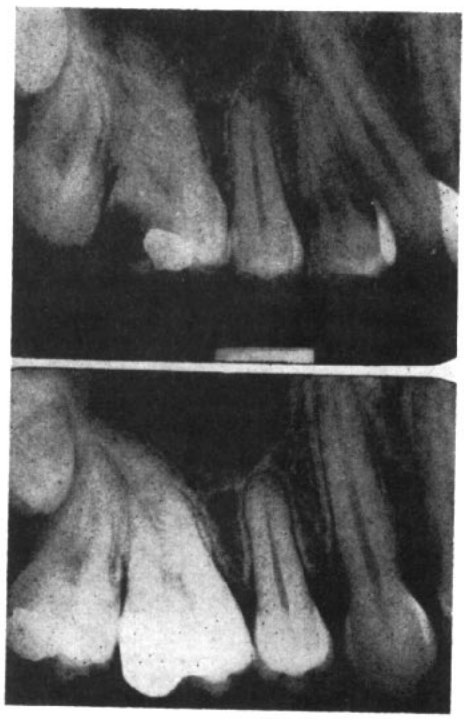

Fig. 6. Before (upper) and after (lower) X-rays of the maxillary left first molar, second premolar and canine indicating axial tipping was avoided during treatment.

Mandibular Arch: A .016 round arch wire was inserted to get bracket engagement, correct rotations and perverted axial inclinations. This was followed at intervals with the insertion of a .018″ x .020″ rounded arch wire, a .021″ x .025″ rectangular arch wire and finally a .022″ x .028″ rectangular arch wire. In the latter, distal tip-back bends in both buccal segments and slight lingual torque in the incisal segment were incorporated. Ligature traction spurs one-eighth inch mesial to the buccal tubes were securely tied to the anchor molars ready for the use of class II elastic force to be applied to the maxillary denture.

In the maxillary denture, buccal sectional arch wires, .021″ x .025″, were inserted on the left side from canine to anchor molar and on the right side from first premolar to anchor molar, for the reception of class two elastic force from the anchorage prepared in the mandibular denture. The elastics were applied from the distal of the anchor molars in the mandibular denture to the mesial of the maxillary buccal sectional arch wires, in order to seat these segments in their correct occlusal inclined plane relationship with the mandibular teeth. After this was accomplished there existed: 1. sufficient maxillary alveolar area for the proper positioning of the maxillary incisal segment; 2. a normal relationship of the mandibular denture to the mandible well within the basal bone; 3. the desired objective in the occusal inclined plane relationship of the buccal segment of the maxillary teeth to these of the mandibular teeth. To complete treatment required only the movement of the maxillary incisor segment into the area created for this purpose.

The lingual movement of the maxillary incisor segment into this area could be accomplished in three ways. 1. The use of intra-maxillary force with its concommitant risk of disturbing the present relationship of the dental units by the possible undesirable mesial movement of the maxillary buccal units.

2. Class II elastic force applied to the maxillary arch wire with its concommitant risk of disturbing the mandibular denture due to the thin labial alveolar wall surrounding the mandibular incisal segment. 3. The use of extra-oral anchorage. The method of choice in this case was cervical anchorage and Class II elastic force.

An ideal .021" x .025" maxillary arch wire was formed; to this was added intermaxillary hooks mesial to the canine of the left side and mesial to the first premolar on the right side. There were no other attachments on the arch wire in order to permit it to slide through the brackets and the buccal tubes on the molars; the arch wire moved distally, carrying the incisal segment lingually, as the result of the pull exerted by the extra-oral force.

After the incisor segment was placed in its proper position, the bands were removed from all the teeth except the four anchor molars, two upper central incisors and the the lower central incisors. The lingual of the maxillary right canine was stoned and polished to permit its lingual positioning in the space normally assigned to a lateral incisor and its incisal point was removed so that it would be shorter than the central incisors. Maxillary and mandibular .020" round arch wires, carrying ligature traction spurs one-eighth inch mesial to the buccal tubes, were inserted and ligature traction applied to close all spaces.

After the spaces were closed, the remaining appliances were removed and maxillary and mandibular Hawley retainers constructed. The prognosis for stability seemed good.

Results of Treatment

1. The molar relationship was retained.

2. The overbite, rotations, axial positioning and proximal contacts were corrected.

3. The teeth were upright and well within the alveolar process.

4. Good dental esthetics and good facial balance.

Summary

The case reported is an Angle Class I mutilated malocclusion complicated by the loss of mandibular first molars and a diseased upper lateral incisor. Associated with it was an anterior migration of the maxillary buccal segments, good facial harmony and balance. Because of this balance, general expansion of the maxillary dental arch, labial movement of its incisor segment and mesial movement of the mandible, or its denture, or both, was contra-indicated. To have treated this case and retained all the dental units would have produced a bimaxillary protusion.

The plan of treatment was designed to maintain the original occlusal inclined plane relationship of the teeth in the buccal segments, the original condyle-glenoid fossa relationship in the temporo-mandibular joint, and to correct all irregularities with a minimum of buccal or labial expansion of the maxillary dental arch. Two maxillary dental units were sacrificed, namely, the upper right lateral incisor and the upper left first premolar.

Every case of malocclusion must be studied carefully and treated according to the individual problems characteristic of the case involved. Treatment of malocclusion cannot be based completely on the classification of malocclusion. Classification of malocclusion is nothing more nor less than the grouping of cases exhibiting a common mandibular cranial relationship.

Patient Recalled Three Years Out of Retention

To evaluate the present state of the case, the patient was recalled for examination three years after discontinuing the wearing of retaining appliances and impressions were taken for com-

parative study. In the following discussion models will be referred to as #1—before treatment, #2—after treatment, #3—three years out of retention.

Gross examination reveals the collapse of the maxillary denture particularly in the incisor segment. There has been little change in the mandibular denture. The occlusal inclined plane relationship has remained stable (Figure 2).

Measurements were made to determine the degree and areas of collapse. The measurements of molar area are from the center of the mesial fossa of the upper right first molar to the center of the mesial fossa of the upper left first molar.

Due to the removal of the upper left first premolar and upper right lateral incisor, model #2 is the only control measurement available in this area. The measurements are from the mesial fossa of the maxillary right first premolar to the incisal tip of the left canine.

The measurements (Table 1) indicate an increase of 4mm. in arch width in the molar region during treatment and a return to the original measurement after removal of retention. In the inter-canine area there has been a reduction of 2.5 m.m. between models #2 and #3.

Though every effort was made in diagnosis to determine where the teeth should be placed in this case, and treatment carried out in an orderly manner, an unanticipated amount of movement of teeth occurred following retention. The prediction of stability in the prognosis was wrong after nature had the last word.

It may be that atavism and the morphologic and genetic neuro-muscular contractile forces of the surrounding musculature of the denture have exerted their influences after the removal of retention. Brodie has concluded that the movement of teeth does not influence the extra-oral tissues.

There was no expansion in the mandibular dental arch. The expansion of the maxillary denture was necessary to correct the bucco-lingual dental relationship of the two dentures. Under the circumstances it may be assumed that the maxillary dental expansion in this slightly underdeveloped maxilla (as related to its mandibular mate) was within the physiological limitations of treatment. Therefore, the evidence seems to point to the morphologic, functional and neuro-muscular influences of the surrounding and associated tissues of the maxillary denture. Is it possible that the slightly underdeveloped maxilla is to some degree partially the result of the above?

Although all living protoplasm exhibits contractility to some degree, contractility is a characteristic of muscular tissue primarily, contraction taking place along definite lines.

The muscular influences involved in this case are not the muscles of mastication but some of the deep layer of the facial muscles. In general the origin of the facial muscles is either from fascia or the bones of the face and they insert into the skin. The individual muscles seldom remain separate and distinct throughout their length because of a tendency to merge with their neighbors at their terminations or attachments.

TABLE I.

	Before	*After*	*Final*	*Difference*
⌈6 mesial fossa — ⌊6 mesial fossa	38mm.	42mm.	38mm.	4mm.
⌈1 mesial fossa — ⌊3 incisal tip	mm.	34mm.	31.5mm.	2.5mm.

These muscles are the Orbicularis oris, Nasalis, Levator labii superioris, Levator angulii oris, Risorius, Depressor angulii oris and the Buccinator. None of these muscles are utilized in the forces of mastication.

One other important factor is the "boule de Bichat" or sucking cushion. This is a mass of fat between the Buccinator and Masseter muscles. It is supposed to receive and distribute the increased atmospheric pressure which follows the establishment of a partial vacuum in the mouth during sucking. It is relatively smaller in adults than in infants.

Conclusion

If the above discussion merits a conclusion, then the examination of the muscular system surrounding and associated with the dentures morphologically and functionally is of the utmost importance. It is this muscular system that maintains and influences the denture and its supporting jaw bones.

There are a number of points to which particular attention must be paid in the examination of the muscular system: observation of muscle status, volume and contour; palpation in order to determine consistency, that is, whether there is normal resiliency, and the relative tanicity.

The question of tonus is still complicated. The state of muscle tonicity is determined by the amount of resistance encountered in passive motion and the extensibility at the various joints.

The removal of the two maxillary dental units, though it enabled the attainment of the optimum in treatment, violated the limitation imposed by the surrounding muscular system. The dictation of the neuro-muscular force over bone reigned supreme: there has been a return of the maxillary denture to it's original width. It was advisable in this case to have the patient wear a maxillary retainer during sleeping hours indefinitely.

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