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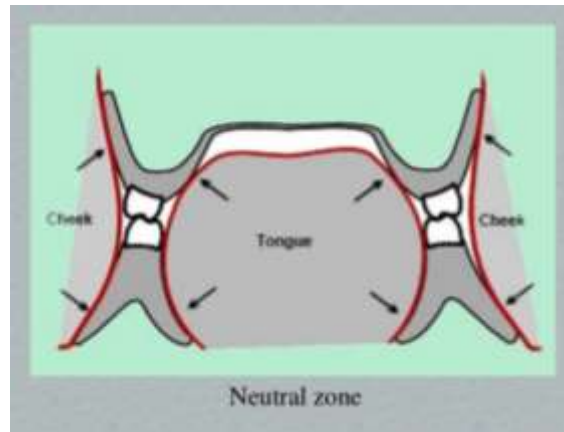
Etiology of Malocclusion**Muscle factors**

The teeth erupt into an environment of functional activity governed by the muscles of mastication of the tongue and of the face. The muscles of the tongue, lips and cheeks are of particular importance in guiding the teeth into their final position. Variation in muscle form and function can affect the position and occlusion of the teeth. It must be remembered that all muscles, exert their influence by virtue of the site of their origins and insertions. The muscles of the lips, cheeks and tongue have their main origins on the basal parts of the jaws and therefore the position of the jaws must affect the position and action of the muscles which function on the teeth.

Thus, it is not realistic to consider the muscles in isolation without reference to the bony structures with which they interrelate in guiding the erupting teeth.

Neutral zone: The fact that the lip and cheek muscle function outside and the tongue within the dental arches has led to the concept of a neutral zone existing between the inner and outer perimeter of the dental arches where the forces of the lip and cheek on the one hand and of the tongue on the other hand are balanced and within which the teeth are positioned. The final

stable position of the teeth in occlusion guided by the effect of these muscle.



The lips

The several muscles making up the lips can conveniently be considered as a single functional unit.

They play their part in occlusal development by virtue of their size, form and function. The **form and function** of the lips can be considered in two planes, vertical and sagittal.

Vertical form of the lips

In the ideal lip form, the lip muscles in their position of resting posture meet together with no or minimal muscle contraction, this is called (competent lip).

In many individuals the lips do not meet together in the rest position unless excessive muscle contraction is made, a condition referred to as (lip incompetence). On the other, sometimes the lip are competent but there competence is prevented by the proclination of the upper incisors this called (potentially competent lips).

The importance of discrepancies in vertical size or form of the lips lies in the fact that the lips are usually brought together during swallowing and speech movements. If they are of sufficient size to be together at rest, then lip closure will not place extra forces on the teeth. If the lips at rest are apart, then muscular contraction will be required to bring them together during swallowing and speech, such contraction will impose extra forces on the erupting teeth. Furthermore, some people whose lips do not meet at rest maintain a conscious lip closure for much of the time, again imposing muscular forces on the teeth. The effect of these forces on the erupting teeth depends to a large extent on the sagittal relationship of the lips.

So the causes of lip incompetence may be discrepancies in the lips, which too short in the vertical dimension or due to their wrong shape to meet together at rest. In some the space between the lips at rest is very pronounced. The reason for this discrepancy may be in the shape of the jaws for example, when a high mandibular gonial angle places the origin of the lower lip too far down in relation to the upper lip.



Fig. 1 Variation in the form of the lips in the vertical dimension, (a) The lips are of sufficient size to meet at rest, (b) Vertical lip incompetence. At rest the lips are apart.

Sagittal relationship of the lips

The sagittal relationship of the lips is almost entirely determined by the relationship of the basal bone of the jaws to which they are attached. The lower lip tends to be further back than the upper lip in a skeletal Class II relationship and further forward in a skeletal Class III relationship. This not only increases the difficulty of putting the lips together, but also may cause the lower lip to modify the eruptive path of the upper incisors. The lower lip plays more part than the upper lip both in functional movement (swallowing, speaking and smiling) and in controlling the position of the incisors.

Such modification may alter the primary effect of the skeletal relationship on the occlusal relationship of the teeth, either increasing or reducing the effect of any skeletal discrepancy.

*In sever skeletal discrepancy cases, the lower lip may function completely behind the upper incisors without causing them to procline.

*In less sever skeletal discrepancy cases, The lower lip may function partially behind the upper incisors causing them to proclain and this will increase the severity of CII malocclusion.



Fig.2 Variation in lip position in the sagittal dimension. This is essentially due to Variation in basal bone relationship.

* On the other hand, with skeletal CII, the lower lip functions entirely in front of the upper incisors, causing them to be retroclined into the CII Division 2 incisor relationship.



Fig.3 the effect of skeletal relationship on lip function and incisor position.

(a) In a Mild skeletal ClassII the lower lip May procline the upper incisors.

(b) In a more severe Skeletal Class II the lower lip can function behind the upper incisors without causing proclination.



The lip-line

The level at which the lips meet together in normal function. The ideal level of the lip-line is approximately at the junction of the middle and the incisal third of the upper incisors. The position of the lip-line in relation to the incisor teeth plays a part in controlling the position of those teeth. Usually a low lip line in CII div. 1 cases in which part of the lower lip may function

behind the upper incisors causing proclination of upper anterior teeth while high lip line seen in Class II div. 2 cases.

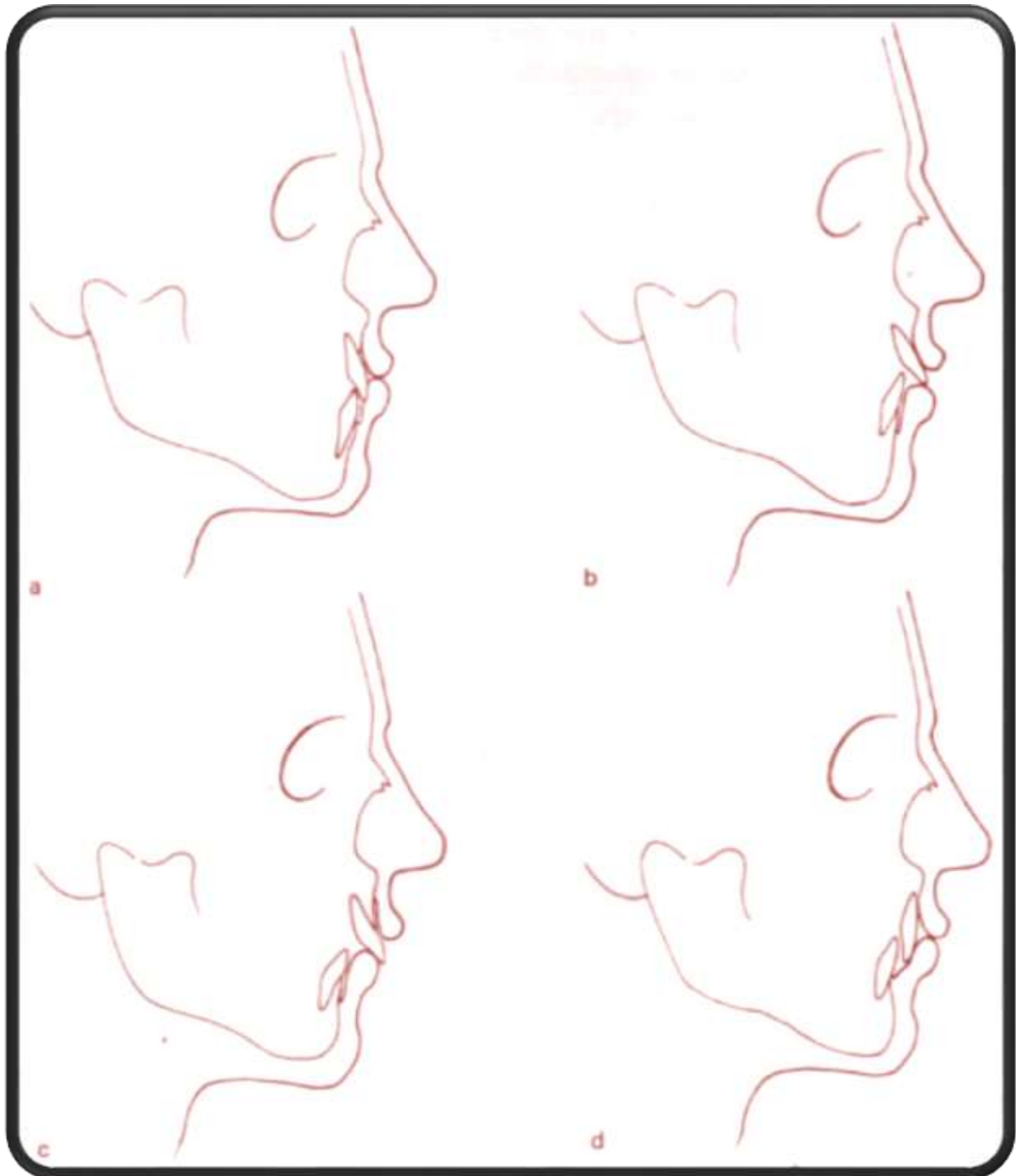


Fig.4. Variation in lip-line, (a) The ideal level, the lower lip controlling the upper incisors, (b) A low lip-line, the lower lip functioning partly behind the upper incisors, (c) The lower lip functioning completely behind the upper incisors, (d) A high lip-line, the lower lip exerting extra control over the upper incisors, which are retroclined.

Etiology of Malocclusion

Muscle factors

The tongue

The tongue functioning mainly in conjunction with the lips and cheeks, it is the other major guiding force for the erupting teeth. The extrinsic muscles of the tongue are attached to the inner aspects of the mandible, the hyoid bone, the palate and the styloid process. It therefore lies within the arch of the lower jaw and affects the developing teeth by virtue of its **size, its resting posture and its function.**

Tongue size and posture

The resting position of the tongue is ideally completely within the lower dental arch filling the space enclosed by the teeth, The dorsum of the tongue touches the palate, while its tip rest against the cingula **of the upper incisors.**

Tongue size in relation to the **size** of the lower jaw is rarely at fault. Occasionally, if the lower jaw is larger than the upper jaw the tongue is too large to fit within the upper dental arch. In such cases the tongue usually finds space between the upper and lower arches and prevents the full vertical development of the dento-alveolar structures resulting in open bite of varying extent.

Function of the tongue

The muscular function of the tongue is particularly concerned with mastication, swallowing and speech. Its effect on the developing dentition is mainly with regard to swallowing function. The essential features of normal swallowing of solid food and saliva are:

1. Closure of the lips.
2. Teeth in light occlusal contact.
3. Tongue elevated to the palate.
4. Momentary clenching of the teeth as food passes into the pharynx.

Human have two types of swallowing according to the age:

1-Infantile (neonatal) swallowing

2-mature (adult) swallowing

The neonatal swallowing characterized by:

- 1- Active contraction of the lip muscles
- 2- Tongue is placed between the gum pads and tongue tip is brought forward into contact with the lower lip.
- 3- Little posterior tongue activity/pharyngeal muscle activity.
- 4- Contraction of lips and facial muscles helps to stabilize the mandible.
- 5- Vigorous mandibular thrust.

***Physiological transition of swallowing behaviour begins during the first year of life and continue for several years.**

****Mature swallowing usually seen by 4-5 years.**

Variations of normal swallowing

Many variations of normal swallowing activity are seen. There is no complete agreement regarding the nature and origin of these variations. Furthermore, the effects of these variations on the developing occlusion are themselves not constant. In the light of current knowledge and experience two main patterns of variation could be described. They may be described as follows:

1. Tooth apart adaptive swallowing

In swallowing with the buccal teeth apart, the tongue is positioned between the teeth and therefore does not fill the upper arch.



The external pressure from both muscles and air on the upper arch are therefore increased and this may lead to narrowing of the arch and may cause buccal crossbite. Full vertical development Of the dento-alveolar segments may be prevented by the tongue, leading to incomplete overbite.

2. Tooth together adaptive swallowing

The adaptive swallowing with the buccal teeth together involves the forward positioning of the tongue between the incisor teeth during swallowing. This usually results in the production of an incomplete overbite or anterior open bite.



3. Tongue thrust

A thrust of the tongue between the teeth during various activities of the tongue such as swallowing, speech etc.

Types: 1. Endogenous tongue thrust.

2. Adaptive tongue thrust.

Endogenous tongue thrust:

Endogenous tongue thrust is an inherited atypical pattern of tongue movement due to neuromuscular activity. Its control is very difficult due to strong intensity. It is often associated with an abnormality of speech (lisp). Repositioning the teeth would not be likely to alter the tongue activity and any open bite caused by the tongue thrust would be likely to recur.

Adaptive tongue thrust:

Is a less vigorous thrust of the tongue during the various activities of the tongue that is according to **functional need**. It has less thrust because it occurs in the maintenance of an anterior oral seal to close the gap in between upper and lower incisors in case of skeletal pattern class II & incompetent lip posture.

Effects of tongue thrust: Tongue thrust or a adaptive swallowing may effect the occlusion in one or more way:

1. **Anterior open bite** (Incomplete & reduced overbite).
2. **Posterior open bite.**
3. **Unilateral or bilateral cross bite** (Narrowing of the upper arch) .
4. **Bilateral cross bite.**
5. **Increased over jet.**
6. **Bilateral proclination and spacing in the anterior segment.**

The sucking habit

Nutritive Sucking is a rhythmic activity, which is a kind of normal method of infant feeding, includes the production of negative intra-oral pressure during breast or bottle-feeding.

Non-nutritive sucking is the placement of the thumb or one or more fingers in the oral cavity with/without repeated and forceful sucking that associated with strong buccal and lip contraction. Thumb and finger sucking activity are so closely related to the oral musculature that it is convenient to consider it at this point. This activity is so common in young children that it can be considered as normal in infancy. There is some difference of opinion as to whether digit sucking activity is learned or innate. Usually it starts very early in childhood being evident within a very short time after birth and there is evidence to suggest that it may begin before birth.

Considerable controversy exists on the topic of thumb, finger and pacifier sucking (non_nutritive sucking) regarding the potential harm of these habits on the developing occlusion.

*Thumb and finger sucking habits only really become a problem if they persist into the period of the permanent dentition.

**Before the permanent dentition period, it's unlikely that these habits affect the growth of the basal parts of the jaws, their effects being confined to the teeth and the alveolar processes of the jaws. When the habit is stopped, the anterior dento-alveolar segments will usually grow into correct occlusal positions.

The effects of the sucking habits

The effects of sucking habits on the occlusal development are variable and to some extent depend on the actual pattern of the habit activity. The thumb sucking may be expected to have a different effect from finger sucking. Sometimes no effect can be seen.

There are many types of habitual sucking activity, Some involving digit sucking others involving sucking of the tongue or lips. A reduced intra oral air pressure is created by lowering the mandible and tongue. In some children the tongue is protruded beneath the thumb, so that both thumb and tongue are between the teeth. In others, only the thumb lies between the teeth. The lower incisors may produce a patch of hardened skin on the back of the thumb.





Most commonly, the presence of the thumb between the erupting teeth causes an anterior open bite being more pronounced on the side on which the thumb is sucked (The effects may be symmetrical or asymmetrical depends on the position of sucked finger).



If the tongue is also protruded, the open bite tends to be larger. There is also often a unilateral cross bite. It is thought that the crossbite is brought about by the slight narrowing of the upper dental arch, resulting from the reduced intra oral air pressure, possibly combined with the activity of the buccal musculature.



The effects of a persistent digit sucking habit on the occlusion: the upper incisors have been proclined and the lower incisors retroclined.

- 1• Proclination of the upper incisors;
- 2• Retroclination of the lower labial segment;
- 3• An incomplete overbite or a localized anterior open bite;
- 4• Narrowing of the upper arch, thought to be mediated by the tongue taking up a lower position in the mouth and the negative pressure generated during sucking of the digit.

The first two effects will contribute to an increase in overjet. The effects of a habit will be superimposed upon the child's existing skeletal pattern and incisor relationship and thus can lead to an increased overjet in a child with a Class I or Class III skeletal pattern or can exacerbate a pre-existing Class II malocclusion.

The effects of a habit depend upon its duration and intensity. If a persistent digit-sucking habit continues into the mixed and permanent dentitions, this can result in an anterior open bite due to restriction of development of the incisors by the finger or thumb. Constriction of the upper arch is believed to be caused by cheek pressure and a low tongue position.

Prolonged habits can have deleterious effects on the occlusion. The extent of these effects varies from case to case, depending on a wide range of variables:

1. **Duration of sucking** (A persistent digit-sucking habit will act like an orthodontic force upon the teeth if indulged in for more than a few hours per day).
2. **Number of fingers involved in sucking.**
3. **Position of fingers.**

4. Intensity of the habitual activity.

5. Position of the tongue.

6. The inherent dental and skeletal relationship.

Dummy (pacifier) sucking

The sucking of a dummy or comforter is usually confined to the first 3 or 4 years of life being given up on the whole sooner than thumb sucking. It produces in most cases, some degree of anterior open bite in the primary teeth unless the hard ring of the dummy is held between the teeth, in which case it can produce other tooth malposition. Its effects on the developing occlusion seem to be transient.



Patient aged 10 years with a dummy-sucking habit: (a) at presentation; (b) 4 months after habit stopped. After a sucking habit stops the open bite tends to resolve, although this may take several months. During this period the tongue may come forward during swallowing to achieve an anterior seal. In a small proportion of cases where the habit has continued until growth is complete the open bite may persist.

Following habit cessation, there is generally some spontaneous correction of the malocclusion. The extent to which malocclusions self-correct varies depending on the age of the patient at the time of habit cessation as well as the severity of the malocclusion resulting from the habit. In general, there is a reduction of the dental open bite and a decrease in maxillary incisor proclination. Anteroposterior dental

and skeletal changes associated with or caused by prolonged digit habits (e.g., Class II malocclusion) are much less likely to self-correct than are the anterior dental changes.

The decision regarding whether or not to interfere with a non-nutritive sucking habit in the primary dentition should be guided by the following factors:

(1) If the digit sucking is associated with a distal step molar relationship (developing Class II malocclusion) the skeletal malocclusion generally worsens the longer the habit continues.

(2) If the child is developing a Class III malocclusion or is prognathic, digit-sucking habits are believed to be less deleterious and may in fact be beneficial for dental development.

(3) Anterior open bites secondary to digit sucking do not generally need to be treated because spontaneous correction generally occurs following habit cessation, especially if the habit ceases before 9 years of age.

TREATMENT

Sometimes it is recommended to treat the sucking habit, even in deciduous dentition due to medical reasons, perhaps microorganisms which may be introduced inside and cause GIT upset may contaminate the child's digit. In most cases, treatment for a prolonged non-nutritive sucking habit should be initiated between the age of 4 years and the eruption time of the permanent incisors.

Treatment approaches of a sucking habit include the followings:

1. Direct Interview

The simplest approach to habit therapy is a straightforward discussion between the child and the dentist that expresses concern and includes an explanation by the dentist. It is most effective with older children.

2. Reward System

A reward system can be implemented that provides a small noticeable reward daily for not engaging in the habit.

3. Reminder Therapy

Appliance and non-appliance reminders are available.

***Non-appliance Reminder Therapy**

It's best suited for those patients who desire to stop the habit, but need assistance to do so. An explanation is usually needed, so the child should understand that this is not punishment. They include the follows: (Thumb guard, An adhesive bandage with waterproof tape on the finger that is sucked, Chemicals with hot flavored, bitter taste placed on the sucked digits).



***Appliance Reminder Therapy**

If the previous methods have not succeeded in eliminating the habit and the child really want to quit, the appliance reminders either removable or fixed could be used. The child should understand the problem and the need for an appliance. Support and encouragement is necessary from the parents to help the child through the treatment period.

