Research Article

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Changes in Oral Functions and Posture at Rest Following Surgical Orthodontic Treatment and Myofunctional Therapy

Evaluation by Means of Video Recording

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Fifteen adult patients with skeletal mandibular prognathism or openbite underwent surgical and orthodontic treatment, then received myofunctional therapy. Cephalograms, facial photographs and oral models were taken on each patient. Patients were then videotaped, frontally and laterally. Observations were made of forty different oral behaviors and oral rest posture. Changes in morphology, speech, and swallowing are described and evaluated.

INTRODUCTION

Patients with jaw deformity possess imbalanced maxillofacial morphology with abnormal growth, disordered orofacial function, incorrect oral rest posture and damaging habits (Figure 1). The maxillofacial deformities of these patients can be corrected by surgical orthodontic treatment. Problems in morphological relationships of the jaws, occlusion, or facial profile justify surgical orthodontic treatment for mandibular prognathism and skeletal openbite. Functional changes and improvements resulting from such treatment, however, remain insufficiently investigated.

Figure 1 - The origin of jaw deformity

The purpose of this study was to observe changes in oral function and orofacial behavior after surgical orthodontic treatment and myofunctional therapy. We established a basis for evaluation and compared oral function, tongue and lip rest posture, and muscular behavior before orthognathic surgery and after completion of orthodontic treatment. We then investigated the effect of orofacial myofunctional therapy on function and posture at rest for skeletal Class III patients and openbite cases.

METHOD

Subjects were fifteen adult patients, three males and twelve females, with skeletal mandibular prognathism or openbite. All had undergone surgical orthodontic treatment in the Chiba Hospital of Tokyo Dental College. Eight cases were treated with bilateral jaw surgery (LeFort osteotomy in the maxilla and sagittal splitting of the ramus in the mandible). Seven others were treated with mandibular surgery only. Lateral cephalograms, standardized facial photographs and oral models of the subjects were prepared to analyze orthodontic changes.

Figure 2 - Unbalanced tension of orofacial muscles in class III case.

We introduced myofunctional therapy (MFT) for the oral circumferential muscles after surgery. Most of the exercises followed Zickefoose's method to establish lip closure and normal oral muscle function for swallowing and speech. Training to position the tongue tip was carried out for almost all oral functions because all skeletal Class III patients had low tongue posture. All subjects had strong chin muscles and the upper lip was sometimes sucked into the oral cavity behind the lower lip (Fig. 2). Video tape recordings were made of the subjects faces, both frontal and lateral, in order to document both function and oral rest posture. During video taping, the subjects were seated in a chair, assumed their natural postures, and trained their eyes squarely at a point in the distance. The camera and video recorder were Sony HVC-FI, V0-9800, and V-9850. The video tape procedure facilitated observation of oral habits and permitted repeated viewing.

Subjects were filmed with the face at rest; smiling; opening and closing the mouth; and moving the tongue tip laterally, frontally, and upward. Other observed behaviors included the pronunciation of single words, sentences, swallowing of saliva, water and chewing of different foods, i.e., cookies and cheese. A checklist of oral functions was compiled. Post-surgical results were evaluated according to five grades of improvement: excellent, good, mild, no change, and worsened. The checklist contained 40 items. Ten were general observation items. Twelve pertained to pronunciation. Six related to swallowing, and twelve concerned mastication. Three doctors examined the subjects, compared pre- and post-treatment findings, and prepared graphic formulae.

RESULTS

Morphological Changes. The average length of surgical orthodontic treatment of the 15 cases was two years, three months. The appearance of the lateral profile improved, was more harmonious, and changed from a concave facial type to standard facial type in 12 out of 15 subjects. Three patients retained a straight facial type.

As part of presurgical surgical orthodontic treatment, 10 cases had two upper premolars extracted and two cases had two lower premolars extracted. The occlusal relationships of eight cases became Class II between upper and lower first molars because of the extraction of the first upper premolars. The other seven cases finished with Class I molar relationships with good lateral interdigitation. After the surgical/orthodontic treatment, all 15 cases had satisfactory occlusion and normal jaw relationships.

General observations after surgical orthodontic treatment and MFT. The protrusive appearance of the

subject's chins was reduced and each developed a good profile. In 10 cases, muscle tone during smiling improved, creating a more natural and cheerful appearance. Although excessive activity in the mentalis was noted during lip closure in almost all subjects during pretreatment observation, nine cases showed decreased mentalis activity cases, particularly demonstrated dramatic improvement. In one subject, mentalis activity increased following treatment.

Pretreatment observations of lip licking or lip sucking showed that the lips were often brought into the oral cavity after the tongue was thrust forward during rest or conversation. The patients' tongues were visible in a low position in the lower arch while at rest and during conversation. Thirteen of these patients achieved an elevated, normal tongue posture at rest and during speech.

Tooth indentations visible on the sides of the tongue decreased in 9 cases; in six cases they remained. With treatment, coordinated motion between the lips and tongue improved and became smooth.

Articulation and pronunciation. Before treatment, breath leakage and low tongue posture and movement were detected and pronunciation of the /sa/ and /ta/ sounds when preceded by vowels were especially unclear. Patients were trained in the articulation of /ta/, /na/ and /ra/ syllables and in the pronunciation of short words, ie. "sakura," "tanuki," "tanaka" and "dotera." Breath leakage and low tongue posturing decreased after treatment. The tongue was habitually postured on the alveolar ridge. Excessive lip contraction persisted in two cases. In most cases, tongue thrusting and lip licking during speech decreased. Generally, articulation became more precise with improved speech clarity.

Swallowing and deglutition. Observations of deglutition were made as the subjects drank water from a glass and swallowed saliva. Before treatment, excessive contraction of the lips and facial muscles were observed during these activities. Strong contraction of the lips and sucking of the lips into the oral cavity was noted during rest, swallowing and immediately after swallowing. This excessive muscle tension decreased markedly after treatment in two cases and improved in five others. Tongue thrust diminished in 9 cases although excessive contraction of the orofacial muscles persisted in others. No subjects swallowed with lips apart. All subjects ceased lip sucking during swallowing. Swallowing motions became more natural.

Chewing and mastication. Eleven of the fifteen subjects were examined for chewing and mastication. Prior to treatment~ seven subjects did not demonstrate rhythmic chewing. Lateral shift of the mandible accompanied by unilateral chewing was observed in

eight cases. Rhythmic chewing was observed in six patients post treatment, along with bilateral chewing in four subjects. Mandibular motion appeared more natural. Lip licking and hyperactivity of the lip muscles decreased after treatment. Tongue tip position and tongue movement during mastication improved in seven cases. Although tongue thrusting during chewing improved in three cases, the habit persisted in four others. In general, coordinated movement of the lips and tongue were improved during mastication.

DISCUSSION

Harmonious oral facial muscle function and posture are exceedingly important for the stability of normal dentition following surgical orthodontic treatment. Surgical orthodontic treatment sufficiently corrects maxillofacial morphology, but does not necessarily improve oral function and muscle posture (Figure 3). therefore myofunctional treatment becomes necessary to improve oral posture and the function of the tongue, lips, and jaw muscles.

Three principal functions of the mouth are mastication, deglutition and pronunciation. In earlier studies, they have been investigated by means of dynamic palatography, electromyography, muscular pressure measurement, and video fluorography among techniques. This study observed changes in oral function and muscular behavior after surgical orthodontic treatment and MFT by means of video photography. Because the video camera is capable of recording the oral circumferential muscles during muscular behavior, this technology is useful in studying oral habits and muscular contraction.

Relapse in some cases after surgical orthodontic treatment may be due to muscular imbalance in the oral facial muscles and poor tongue position during function

and rest. For this reason patients are introduced to Zickefoose's myofunctional exercises. The major goals of this treatment include: establishment of a relaxed oral rest posture with the lips gently sealed, the tongue up in the palate posterior to the incisal papilla, and the teeth slightly apart; elimination of damaging oral habits, and; establishment of normal tongue, lip and jaw movements during functions of chewing, swallowing and speech. Myofunctional therapy exercises are necessary to develop natural orofacial rest posture and normal behavior of the tongue tip and the oral circumferential muscles. Brodie also stressed the importance of the buccinator mechanism which supports the dentition from outside the oral cavity. Just as an unbalanced occlusion is thought to be less stable, incorrect oral muscle posture and functioning can also influence morphology adversely and contribute to relapse (Yamaguchi, H, Sebata M, et al, 1994). Therefore, exercises to develop normal oral muscle behavior for functions and oral posture at rest are very important in maintaining a balanced occlusion (Fig. 4).

SUMMARY

The faces of fifteen adults with jaw deformities were videotaped before and after surgical orthodontic treatment and myofunctional therapy. Observations were made of their pre and post treatment oral circumferential behavior for function and their resting facial muscle posture. After surgery and orthodontic treatment, improvement in occlusion and facial harmony were apparent. Study and observation of the videotape films indicated improvements in orofacial posture, muscle tone, function in speech and swallowing and reduction of damaging muscle pressure habits.

Good relationships between morphology, oral function, and muscular behavior are very important for

Figure 3 - The necessity of the MFT for correction of oral function and posture.

Figure 4 - Maintained forces in connection with the balanced occlusion.

the stability of normal dentition and normal jaw relationship after surgical orthodontic treatment. Normally maintained forces from a balanced occlusion also reduce the possibility of relapse.

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