

Head Posture: A Case Study of the Effects on the Rest Position of the Mandible*

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Previous research has shown a relationship between head posture and the rest position of the mandible. The purpose in this study was to investigate the changes in the resting vertical dimension of the mandible with correction of a forward head posture in an edentulous patient. Ten treatments of manual physical therapy techniques, such as joint mobilization and muscle stretching to correct the forward head posture, were administered. A plumb line test showed an improvement of the forward head posture. In addition, the resting vertical dimension of the mandible increased an average of 8 millimeters. This result suggests that correct head posture may be necessary to precisely calculate the resting vertical dimension of the mandible.

Goals shared by dentists and physical therapists should be to position and align the musculoskeletal system and allow a balance to be established within that individual system. One aspect of this relationship is the rest position of the mandible which is that position in which all stomatognathic structures are in a balanced, but not necessarily nonpathological, condition.³ This position has the lips in light contact or slightly apart, the opposing teeth are separated, all jaw muscles are at rest from function, and the mandible is passively suspended against gravity.^{2,15,26} Studies have shown that movements of the head may change the stomatognathic system and subsequently the rest position of the mandible.^{4,8,18,19,21,24,26,28,29} The purpose in this study was to investigate changes in the resting vertical dimension of the mandible with correction of a forward head posture in an edentulous patient.

The relations of the muscles of mastication, hyoid bone, and postcervical musculature during head posture are important when considering the effects of head posture on the rest position of the

mandible. Brodie,⁵ using a biomechanical model, described these effects by comparing the previously mentioned muscle groups to pieces of elastic positioned to hold the head erect on the vertebral column. Substituting muscles for the pieces of elastic, Brodie displayed how tension in one group of muscles may result in tension in another group of muscles. The author documented that the rest position of the mandible is determined by muscular equilibrium and that this equilibrium is a function of the maintenance of head posture.

Electromyographic investigations support the relationship between the muscles attached to the mandible and the position of the head.^{12,15,28} These investigations document how inclinations of the head affected the mandibular postural position. Normally, no occlusal contact exists between the maxillary and mandibular teeth when the muscles are relaxed. This distance has been measured to be 2 to 4 millimeters (freeway space, or interocclusal distance).^{2,11,13,15,23,27}

When the resting vertical dimension is decreased, as clinically observed with a forward head posture,¹⁷ and encroaching the freeway space, the mandibular condyle may intrude upward and backward in the glenoid fossa, the teeth may be in contact eliminating the rest position and creating tension on the muscles of mastication and stress on the teeth and supporting structures.^{1,7,11,14,15} According to the British ortho-

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paedic surgeon Wolff, "The external form and the internal structure of living bone change with every alteration of function, that is, a bone has the power to adapt itself to the burden it has to bear". Therefore, this decreased position may lead to pathological resorption of bone or grinding of the teeth.¹⁴

The forward head posture is the position in which the head rests anterior to anatomical points of reference as described by Kendall et al.¹⁶ (Fig. 1). Postural changes include: backward bending of occiput over atlas and atlas on axis leading to functional limitation of movement of the cervical spine and upper thoracic region, decrease in the midcervical lordosis, increase in the upper thoracic kyphosis, and protraction and elevation of the shoulder girdle with internal and downward rotation of the glenohumeral joint. Associated with this forward head position may be an alteration in the homeostasis of the rest position of the mandible, upper thoracic respiration with subsequent

hyperactivity of the respiratory accessory muscles, and mouth breathing with a loss of the rest position of the tongue.²⁰

There is an effect of gravity on a forward head posture which causes an increase in forward tension which induces fatigue and presents a compressive force on the soft tissues.⁶ According to the laws of physics, when a force is applied to a curved structure the area on the convex side is stretched while that on the concave side is compressed.²⁵ Therefore, the faulty mechanics associated with this postural position may lead to excessive compression on the apophyseal joints and posterior surfaces of the vertebral bodies,⁶ excessive lengthening with associated weakness of the anterior vertebral neck flexors, and tightness of the neck extensors.^{13,16} Additional changes include shortening of the suboccipital and suprahyoid musculature and lengthening of the infrahyoid muscles with elevation of the hyoid bone.^{20,29}

In summary, the rest position of the mandible is dependent upon numerous factors, including the tonus of the muscles attached to the mandible which is dependent upon the posture of the head. No research exists which describes the influence of a chronic abnormal head posture on the resting vertical dimension of the mandible.

MATERIALS AND METHODS

One edentulous patient from a university dental clinic in the southeast was studied. The patient was a 48-year-old woman who came to the dental clinic with a complaint of loose dentures. Her history revealed head and neck pain of 4 years duration. The purpose for the project was explained and the patient signed an informed consent form.

The procedure to measure the resting vertical dimension of the mandible was completed by a resident dentist from the Department of Prosthetics. The procedure required the subject to be sitting upright in a dental chair with the head unsupported to avoid gravitational influence on the mandibular position, and utilized a combination of phonetics, esthetic appearance, and deglutition. The phonetics technique utilizes letter and word sounds made by the patient to determine freeway space, while the esthetic appearance method is based upon the esthetic harmony of the lower third of the face relative to the rest of the face, the contour of the lips, and the appearance of the skin from the margin of the lower lip

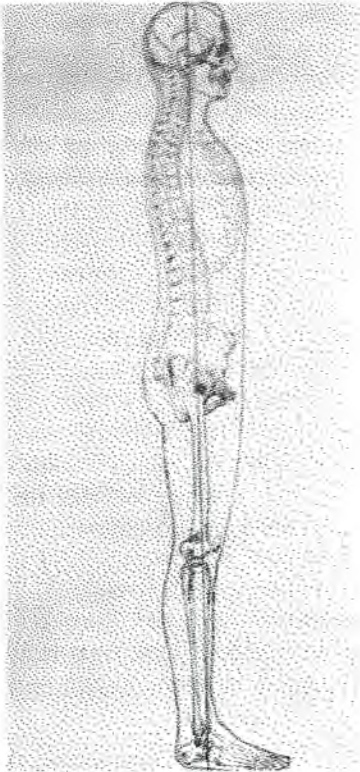


Fig. 1. Anatomical surface landmarks of the standard posture. Through the lobe of the ear. Through the shoulder joint (providing the arms hang in normal alignment in relation to the thorax). Approximately midway between front and back of the chest. Approximately midway between the back and the abdomen. Approximately through the greater trochanter of the femur. Slightly anterior to a midline through the knee. Slightly anterior to the lateral malleolus.

to the lower border of the chin. The deglutition procedure is used to produce the upper limit of the freeway space and to assist the mandible to return to its natural position. The reliability of the resident to measure the resting vertical dimension of the mandible was assessed on normal subjects before the investigations ($r = 0.98$).²²

Following the measurement of the resting vertical dimension, the patient was referred to physical therapy for evaluation of the forward head posture. In order to document the forward head posture, photographs were taken with a plumb line passing through the anatomical surface landmarks described by Kendall et al. (Fig. 1). The patient was instructed to stand in her normal, relaxed posture after the investigator aligned her left foot with the plumb line. See Figure 2 for initial evaluation of the forward head posture.

The object of physical therapy was to restore the head, as much as possible, to a position in which the plumb line would pass through anatomical surface landmarks as described in Figure 1. The physical therapy procedures are outlined in Table 1.^{9,20} These procedures were utilized to assist in the correction of the forward head posture. No attempt was made in this investigation to test the effectiveness of these procedures. Subsequent photographs were taken on every third visit to physical therapy in order to monitor the postural progression of the patient. The patient received 10 physical therapy treatments which were completed by the same physical therapist. The treatments were approximately 30 minutes in duration, 3 times per week. The resting vertical dimension of the mandible was measured following the sixth and the tenth treatments, and 1 month following termination of treatment. This time period was selected to allow for anticipated patient changes in head to thorax alignment.

RESULTS

Before physical therapy treatment was implemented, photographs revealed a forward head posture, verified by the plumb line test (Fig. 2). Subsequent photographs showed gradual improvement in head posture following 10 physical therapy sessions. Head posture was restored (Fig. 3) to the points coinciding with those outlined in the standard posture (Fig. 1).

Before physical therapy treatment, the resting vertical dimension of the mandible was measured to be 59 millimeters. The resting vertical dimension was measured to be 67.5 millimeters after

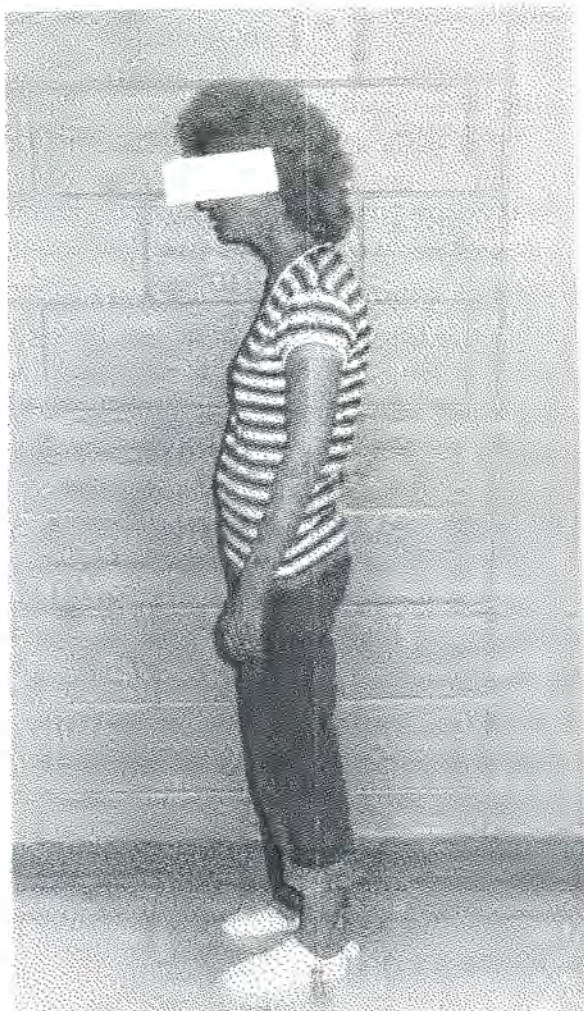


Fig. 2. Photograph of the initial evaluation of forward head posture in an edentulous patient.

six treatments and 66.5 millimeters after 10 treatments. These latter two measurements represented a mean increase of 8 millimeters above the initial resting vertical dimension of the mandible.

Follow-up studies 1 month after the termination of physical therapy treatment revealed a resting vertical dimension of 66.5 millimeters. This measurement indicates the patient maintained her resting vertical dimension and may suggest she maintained the desired postural changes.

DISCUSSION

The results support reports in the literature^{4,5,8,18,19,24,26} that head posture may influence the resting vertical dimension of the mandible, as well as the clinical observation of a decrease in the resting vertical dimension of the

TABLE 1

Physical therapy evaluation and treatment for forward head posture

Physical therapy treatment and evaluation	Purpose of the procedure
1. Observation of head posture	Identification of the position of head in relation to the thorax.
2. Active mobility of the cervical spine (by the patient)	Indication of the patient's ability to perform required movements, such as forward bending, side bending, available range of motion and synergistic motion.
3. Palpation of the cervical spine (by the examiner)	Evaluation of skin temperature, tenderness, localized swelling, and position of cervical structures.
4. Tongue position	Indication of tongue position during rest, speech, and deglutition.
5. Manual muscle stretching (by the examiner) including specific techniques for the following muscles/muscle groups: A. Upper trapezius B. Levator scapulae C. Suboccipital muscles	Lengthening of adaptively shortened musculature to allow the patient to position their head comfortably in the desired posture.
6. Joint mobilization (by the examiner) including specific techniques for the following joints: A. Cervical and upper thoracic apophyseal B. Costo-vertebral C. Acromio-clavicular/sterno-clavicular	Restoration of mobility to restricted joints, such as the apophyseal joint.
7. Active exercises (by the patient) including the following: A. Cervical spine forward bending and rotation B. Axial extension C. Tongue positioning D. Postural awareness	Improvement in cervical spine range of motion.
8. Patient education	Explanation of the purpose of treatment as well as instruction in the desired permanent head and tongue positions.
9. Home exercise program	Enhancement of patient participation as well as to supplement treatment sessions.

mandible with a forward posture. This study examined the effects of correction of an abnormal head posture on the resting vertical dimension of the mandible rather than the anatomic (forward flexion and backward bending), but nonclinical head position used in previous research.^{1,8,26}

From the anatomical arrangement of the musculature of the cervical spine, one may expect a relationship to exist between the musculature controlling the head and the rest position of the mandible so that alterations in head position, such as a forward head posture, will alter the rest position of the mandible. Through adaptive muscle shortening, the supramandibular muscles may pull the mandible toward the maxilla and cause a decrease in the rest position of the mandible, eliminating the freeway space or interocclusal distance. The consequences of this abnormal position may lead to an excessive amount of tension on the masticatory muscles, teeth, and supporting structures.^{1,11,14} This position may lead to eventual osteoarthritis and remodeling of the temporomandibular joint.^{11,19,26,30}

One may speculate that the manual physical therapy techniques used were successful in the

restoration of apophyseal joint mobility as well as stretching contracted muscle groups, thus allowing the patient the ability to position her head comfortably in the position of the standard posture. However, no radiographs were used to verify the postural changes.

The increase in the resting vertical dimension of the mandible is thought to be due to the restoration of normal muscle tone of the suboccipital, supramandibular, and suprahyoid muscles. In addition, active patient exercises, and instruction in resting tongue positioning and nasal breathing, aided in the attainment of asymptomatic functioning of the stomatognathic system as reported by the patient as a decrease in pain.

The clinical implications are several. For the dentist, a change in the resting vertical dimension of the mandible of ± 1 millimeter is considered significant.¹⁰ For the physical therapist, the results indicate the need for recognition and treatment of the forward head posture. In addition, indications are that the treatment procedures may be successful in lessening head and neck pain in an edentulous patient with a forward head posture. Furthermore, the results indicate that the resto-



Fig. 3. Photograph of the corrected head posture of an edentulous patient.

ration of normal head to thorax position is necessary to accurately measure the resting vertical dimension of the mandible. The importance of the results and clinical implications merit further validation with other patients.

CONCLUSION

The results showed that correction of a forward head posture may effect the resting vertical dimension of the mandible. Manual physical therapy techniques were successful in assisting a patient to obtain a desired head to thorax posture as described in the standard posture (Fig. 1). Following correction of an abnormal head posture, the resting vertical dimension of the mandible had a mean increase of 8 millimeters, which was maintained during a 1-month follow-up.

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