Journal of Novel Physiotherapies
Azam, J Nov Physiother 2015, 5:6
http://dx.doi.org/10.4172/2165-7025.1000279

Research Article
Open Access

Efficacy of Stomatognathic Alignment Exercise Program on Mouth Opening Limitation Improvement in Spastic Myogenic Temporomandibular Disorder of Hemiparetic Cerebral Palsy Children

Ahmed M. Azam*

Department of Physiotherapy for Developmental Disturbance and Pediatric Surgery, Faculty of Physical Therapy, Cairo University, Giza, Egypt

***Corresponding author**: Ahmed M. Azam, Department of Physiotherapy for Developmental Disturbance and Pediatric Surgery, Faculty of physical therapy, Cairo university, Giza, Egypt, Tel: 00966548940510; E-mail: prof.ahmedazzam@yahoo.com

Rec date: December 20, 2015**; Acc date:** December 28, 2015**; Pub date:** December 31, 2015

Abstract

Objectives: The aim of this work was to show the efficacy of stomatognathic alignment exercise program on mouth opening limitation improvement in spastic myogenic temporomandibular disorder of hemiparetic cerebral palsy children.

Method: Thirty children were enrolled in this study and randomly assigned into two groups; group A (traditional physiotherapy program plus stomatognathic alignment exercise program), and group B (traditional physiotherapy program only). I used the standard ruler for detecting and follow up mouth opening limitation depends on the ratio between maximum comfortable mouth opening and maximum assisted mouth opening. This measurement was taken before initial treatment and after 12 weeks of treatment. The children parents in both groups A and B were instructed to complete 1 hour of home routine program.

Results: Data analysis was available on the 30 hemiplegic cerebral palsy children participated in the study. The mean value of mouth opening in both groups (assessed by C.M) at baseline measurement (pre-treatment) and (post-treatment) was insignificant ($p>0.05$). Both groups had a significant improvement in mouth opening post-treatment. The average improvement of mouth opening tended to being highly significant in the study group than in the control group. The percentage of improvement of mouth opening were (16%) in the study group compared to the control group (4%).

Conclusion: According the results of this study it can be concluded that the combined effect of physiotherapy training program in addition to stomatognathic alignment exercise program can be recommended in improvement mouth opening ratio in hemiplegic cerebral palsy children.

Keywords: Stomatognathic; Ex spasticity of masticatory muscles; Hemiplegic CP

Introduction

Spasticity is a frequent motor disorder present in individuals with CP, occurring secondary to upper motor neuron lesions. It is characterized by hyper-excitability of the velocity-dependent lengthening reflex and predominantly affects antigravity muscles, with deep reflex increment and increased muscle tone [1].

Individuals with spastic muscles present severely compromised function due to a diminished range of motion, diminished voluntary strength, and increased joint stiffness. The functional impairments caused by CP may lead to a number of oral health complications, including high caries prevalence, a need for altered food consistency, difficulty in mastication due to the biting reflex, and alterations in the salivary parameters [2].

The jaw closing muscles are densely supplied with muscle spindles and a monosynaptic stretch reflex can be evoked readily. The tongue muscles are intermediate between the lip and the jaw muscles. A few spindles have been found in the intrinsic tongue muscles [3].

A relationship between the stomatognathic system and body posture that tension in the stomatognathic system can contribute to impaired neural control of posture. Numerous anatomical connections between the stomatognathic system's proprioceptive inputs and nervous structures are implicated in posture (cerebellum, vestibular and oculomotor nuclei, superior colliculus). If the proprioceptive information of the stomatognathic system is inaccurate, then head control and body position may be affected. In addition, the present review discusses the role the myofascial system plays in posture. If confirmed by further research, these considerations can improve our understanding and treatment of muscular-skeletal disorders that are associated with temporomandibular joint disorders, occlusal changes, and tooth loss [4].

Secondary changes in the early presentation of stroke have been attributed to neurological and biomechanical changes including hypertonus, excessive muscular co-activation, muscle weakness, contracture, and increased muscle stiffness. Increased muscle tonus in the flexors of the neck and upper body could result in shortening of the flexors, which would further result in mechanical impairment of their actions, consequently altering body alignment and movement range. Furthermore, general symptoms of muscle weakness in patients after stroke can influence the postural alignment of the head and neck, resulting in asymmetrical positioning of their bodies due to postural changes and muscle shortening. Postural abnormalities may influence the mandibular position, which may lead to result in changes in proprioceptive and periodontal input, affecting movement patterns and postural stability. Postural and movement faults in the craniocervical regions and impairments in their control may be the primary reason for the decline in the function of the stomatognathic system, including the TMJ, and resultant swallowing problems. An apparent relationship between poorly aligned posture and TMJ dysfunction suggests that the initiation of active exercise to achieve postural correction is a valid treatment option for minimising these symptoms [5].

The limitation of mouth opening is one of the cardinal signs of temporomandibular disorder (TMD). Therefore, evaluation of mouth opening is commonly used as part of routine function assessment of the temporomandibular joints (TMJ) and as outcome parameter in studies evaluating the efficacy of therapeutic interventions. The opening movement is caused by relaxation of the temporalis, masseter and medial pterygoid muscles with combined action of the lateral ptyregoid, geniohyoid and digastric muscles. So spasticity lead to limitation of mouth opening and improving in mouth opening is a landmark for decreasing of spasticity [6].

Limitation of mouth opening may be caused by masticatory muscles hypertonia. Assessment of the mouth opening limitation plays an important role in the clinical examination of the masticatory system. This is probably based upon the assumption that the maximum mouth opening reflects the capacity of the condyle to translate within the joint [7].

The stomatognathic system (SS) also plays an important role in postural control. The SS is a functional unit characterized by several structures: skeletal components (maxilla and mandible), dental arches, soft tissues (salivary glands, nervous and vascular supplies), and the temporomandibular joint and masticatory muscles (MM). These structures act in harmony to perform different functional tasks (to speak, to break food down into small pieces, and to swallow). In particular, the temporomandibular joint makes muscular and ligamentary connections to the cervical region, forming a functional complex called the "cranio-cervico-mandibular system. The extensive afferent and efferent innervations of the SS are reflected in the extensive representation of the orofacial district in the motor and sensory areas of the cerebral cortex [8].

Indirect evidence suggests a functional connection between the vestibular and trigeminal systems. Studies have also revealed connections between the main nucleus of the trigeminus and the oral, interpolar and caudal portion of the spinal trigeminal nucleus on the one hand, with the vestibular nucleus and the prepositus nucleus of the hypoglossus on the other. The prepositus nucleus is part of a small group of nervous cells adjacent to, but not connected with, the nucleus of the hypoglossus. It is also an important nerve center for controlling the position and movement of the eyes, due to its strict relationship with the vestibular nuclei, the cerebellum, and the oculomotor nuclei [9].

All of these anatomical connections suggest that portions of the trigeminal system strongly influence the coordination of posture and sight. It seems likely that sensory information from SS proprioceptive receptors is processed in tandem with information from the vestibular and oculomotor systems. Changes in trigeminal stimulations can cause an imbalance in the vestibular and oculomotor systems [10].

Material and Methods

Subjects

Subject: 30 hemiplegic C.P with age ranged between 6-10 years at the time of recruitment.

The following inclusion criteria were met:

1. No history of jaw, head and face trauma.

2. No history of signs and symptoms in the jaw, face, and neck, either at rest or during function.

3. No history of severe bruxism.

4. No facial or dental developmental abnormalities; and

5. No dental prosthesis on the anterior. Teeth Subjects with neck symptoms were excluded because neck pain has been reported to create limitation of mouth opening.

The thirty subjects that met the study criteria were randomly assigned into two groups:

Group A: Consists of 15 patients (11 females and 4 males) and were treated by traditional physiotherapy program plus stomatognathic alignment exercise program

Group B: Consisted of 15 patients (7 female and 8male) and were treated by traditional physiotherapy program only.

Outcome measurements

A new assessment of mouth opening limitation in myogenic TMD patients depends on the ratio between maximum comfortable mouth opening and maximum assisted mouth opening. The patient was sitting in an upright position in a dental chair, his/her head supported by the headrest. For determining maximum comfortable opening, patients were asked to open as wide as possible without report of pain and then the distance from the incisal edge of the upper central incisor to the incisal edge of the lower central incisor was measured by a ruler. Measurement of maximum comfortable opening was recorded by asking the subjects to open their mouth as wide as possible, while the examiner measured maximum distance from a marked dot on the base of the nose and a second marked dot on the chin at the midline. The choice of using landmarks other than the teeth was due to the fact that many children in the age group of five to seven years had their central incisors either unerupted or partially erupted.

Maximal assisted mouth opening was measured inter-incisally when the mandible was gently forced further apart with pressure from the examiner's thumb on the maxillary incisors and index finger on the mandibular incisors. The patient may feel pain for moments. The Opening Ratio (OR) was then determined as follows:

Maximum comfortable mouth opening (active opening) OR= ×100/ Maximum assisted mouth opening (passive opening)

Measurements of neck mobility were performed using a tape measure; all measurements of neck mobility were performed with patients in a sitting position with back support. During the measurements, the head and neck were placed in the anatomical position, and the thoracic and lumbar spines were supported by a backrest. To avoid compensation through scapular and spinal motions, the subjects were asked to stabilize the shoulder girdle by holding the bottom of the chair. Neck flexion and extension were determined by measuring the distance between the suprasternal notch and the lower tip of the chin at maximal flexion and extension of the neck, respectively. The measurements of rotation and lateral flexion were performed on the affected side and the unaffected side, respectively, thus reflecting the restriction of cervical movement due to soft tissues in the neck region on the affected side. Neck rotation on the affected side was determined by measuring the distance between the tip of the chin and the suprasternal notch of the sternum at maximal neck rotation or distance between tip of nose and the tip of acromion process, and the lateral flexion of the neck on the unaffected side was measured using the distance between the acromion process and the mastoid process of the skull of the affected side at maximal lateral flexion of the neck. The values obtained from 3 trials were averaged to obtain the final value.

Intervention

Both groups (A and B) received a traditional physiotherapy program, as the following

1. Hot packs to improve circulation and relax muscle tension applied on the TMG +cervical region for 20 minutes.

2. Facilitation of anti-spastic muscles (extensors of upper limb and flexors of lower limbs): tapping followed by movement, quick stretch, triggering mass flexion, biofeedback, weight bearing, clenching to toes, compression on bony prominence, rapping the muscle, approximation, vibration, irradiation to weak muscles by strong muscles, and ice application for brief time.

3. Prolonged stretch to spastic muscles to gain relaxation via techniques used as prolonged stretch (positioning, night splint, reflex inhibiting pattern, Bobath technique) for 20 minutes.

4. Passive stretching to tight muscles (wrist flexors+biceps brachii +pronators+hip flexors and adductors+ hamstring+ tendo-achillis muscles) to destruct adhesions in muscles and sheath. It must be decent gentle gradual stretch not over stretch at all, lasting 20 second then relaxation 20 second 3-5 times per session then maintain the new range by using adjustable splint .

5. Graduated active exercise for trunk muscles.

6. Gait training using aids in closed environment using obstacles, side walking followed by pass walking to stimulate protective reaction.

7. Balance training program which include static and dynamic training.

8. Faradic stimulation for anti-spastic muscles. To prevent cross electricity to reach spastic muscles because these spastic muscles are more sensitive to electric stimulation than weak muscles. Mother was asked to support wrist and foot in function positioning during electrical stimulation for 15 minutes.

9. Occlusal splint therapy biofeedback and low-level laser may be udes

The experimental group (group A) received specialized stomatognathic alignment exercise program as following:

The stomatognathic alignment exercise focus on improving the flexibility of the TMJ and neck as well as postural correction, is essential for managing general symptoms of impaired TMJ function after stroke.

The stomatognathic alignment exercise program consisted of:

1. Exercises to increase the mobility of the neck and TMJ (active range of motion [ROM] exercises for the neck and TMJ). In the active ROM exercises for the neck and TMJ, flexion, extension, and lateral flexion and rotation of the neck were performed on the affected and unaffected sides, followed by maximal mouth opening, protrusion, and lateral excursion on the sides for the TMJ while sitting on a chair with a backrest. These exercises were performed with a 10-second hold at the end of the range of motion for each motion, with 2 sets of 10 repetitions performed for each motion.

2. Correct head and neck posture (chin tuck exercise and anterior chest stretching exercise), neck, and postural correction exercises may be more appropriate for improving swallowing function. These exercises have also been commonly used as a therapeutic solution for the recovery of TMJ function

a. In the chin tuck exercise, the chin was pulled backwards over the upper part of the sternum to position the patient's ears in line with the tips of the shoulders. This was repeated 10 times with a 10-second hold in supine, and 5 times with a 2-minute hold in standing against a wall.

b. In the anterior chest stretching exercise, the head and shoulder blades were pressed back against a wall while maintaining the chin tuck position and standing against the wall with a straight back; the arms were maintained at 45° shoulder abduction, with the elbows fully extended and the forearms supinated. This exercise was performed 10 times with a 10-second hold.

3. Behavioural interventions (e.g., sensory stimulation of orofacial and pharyngeal structures, the use of modified food consistency, and postural changes to affect bolus flow)

4. Specific exercises to normalise the swallowing reflex,

5. Strengthening exercises for the orofacial and pharyngolaryngeal muscles,

6. Posture retraining, exercise,

7. Muscular awareness relaxation therapy

8. Cervical-cranial soft tissue manipulation would significantly improve mouth-opening

9. Active Release Technique is a soft tissue technique

During normal mouth opening, extension occurs at the cervical-cranial junction; and restriction in the upper cervical spine may decrease a patient's mouth-opening capacity. Segmental limitations in the upper cervical spine (C0-C3) were significantly more present in patients with TMD [6].

Various functional tasks such as chewing, swallowing, and speaking are carried out by the coordinated action of the stomatognathic system, which includes skeletal and dental components, orofacial soft tissues, the TMJ, and the masticatory muscles. Functional adaptation of the TMJ may be essential to break down food into small pieces by chewing and swallow them, as it is involved in mouth opening and mastication during the initial stages of oral function. Swallowing abnormalities are often observed in patients who are recovering from stroke, and are likely to result in malnutrition and pulmonary complications.

Although there are many therapeutic approaches for managing TMJ dysfunction, invasive methods cannot be used for stroke patients with poor health; therefore, conservative treatment should be considered first. .

During the rehabilitation of stroke patients, it is important to consider TMJ function and swallowing function because of the negative impact of their impairment on the functional performance of daily activities. Thus, therapeutic knowledge about impairments in TMJ function and swallowing function are well known,

effectiveness of exercise therapy for improving TMJ and neck mobility and correcting postural alignment to promote TMJ function and swallowing function of hemiparetic stroke patients.

Results

Patients characteristics

Table 1 shows the demographic and clinical characteristics of all patients. There were 19 patients (63.33%) are boys and 11 patients (36.66%) as girls assessed by years .There were right hand dominance reported in 19 patients (63.33%), while 11 patients (36.66%) were left handed. There was no significant difference between both groups in terms of age (p=0.7196), sex (p= 0.7165) and in hand dominances (p=0.2712).

Variables	Study group	Control group	p-value
	N=15	N=15	
age	7.93 ± 1.49	7.73 ± 1.53	0.7196
Sex			
boys	9 M(60%)	10M(66.66%)	0.7165
girls	6 F(40%)	5F(33.33%)	
Hand dominance			
RT	8(53.33%)	11(73.33%)	0.2712
LT	7(46.66%)	4(26.66%)	

Table 1: Patients' characteristics.

Changes in mouth opening

Mean test scores and standard deviations for both groups are shown in the table 2. The mean value of mouth opening in both groups (assessed by C.M) at baseline measurement (pre-treatment) and (post-treatment) was insignificant (p>0.05). Both groups had a significant improvement in mouth opening post-treatment. The average improvement of mouth opening tended to being highly significant in the study group (6.73 ± 1.22 versus 7.80 ± 1.15, p=0.0001) than in the control group (7.00 ± 1.25 versus 7.27 ± 1.22, p=0.0406). The percentage of improvement of mouth opening were (16%) in the study group compared to the control group (4%).

Clinical observations indicate that many patients with post-stroke hemiparesis generally have poor posture. Their sitting postures are typically characterized formed by a backward pelvic tilt, flexed trunk, and forward head position with a tendency of lateral trunk flexion and lateral pelvic tilt with consequent asymmetrical weight bearing on the buttocks. Forward head posture results from the shortening of the posterior neck muscles (including the suboccipital, splenii, semispinalis, and upper trapezius muscles) and the sternocleidomastoid muscles. Muscular and ligamentary connections of the TMJ with the cervical region form a functional complex in the craniocervical and mandibular regions, and postural abnormality in these regions is often associated with TMJ dysfunction. In the present study, the main focus of the stomatognathic alignment exercise included enhancement of the mobility of the neck and the TMJ, and restoration of postural alignment of the head and neck, with the aim of achieving functional improvement of the stomatognathic system [11].

Average test of mouth opening	Study group	Control group	p-value
	Mean ± SD	Mean ± SD	
Pre-treatment	6.73 ± 1.22	7.00 ± 1.25	0.5601
Post-treatment	7.80 ± 1.15	7.27 ± 1.22	0.2045
%improvment	16%	4%	0.8771
p-value (within group)	0.0001	0.0406	

Table 2: The average test of mouth opening in both groups.

TMJ dysfunction is reported to be strongly associated with a decrease in chewing function, which is probably a factor contributing to dysphagia and malnutrition, and has an important impact on the quality of life related to oral health of patients with post-stroke hemiparesis. Limitations in TMJ and neck mobility may decrease the ability to chew by repetitive mandibular depression and elevation, and may negatively influence lingual mobility as well as antero-superior movement of the hyoid. This indicates the importance of mobility exercises for the TMJ and neck regions in the achievement of airway closure, for decrease of aspiration risk, by facilitating hyoid-laryngeal elevation. Therefore, it is important to encourage this type of exercise to improve orofacial and pharyngolaryngeal movements during swallowing by patients presenting TMJ and neck stiffness, enabling them to re-learn the use of the swallowing-related muscles [12].

During the swallowing process, the extrinsic muscles, such as the suprahyoid, infrahyoid, and sternocleidomastoid muscles, control vocal cord vibration and promote the contraction of the vocal cords, which then move forward on the larynx, thereby protecting the airway by laryngeal closure. However, deviations in the head and neck posture alter the length-tension relationship of the intrinsic and extrinsic muscles that are located in the pharyngolaryngeal regions affecting control of the action of these muscles. Therefore, normalising the function of the pharyngolaryngeal muscles and maintaining appropriate muscular compliance should be performed first to optimise swallowing function after stroke. Thus we attribute the improvement in TMJ function and swallowing function seen in the present study to the improved neck mobility [13].

The linkage between the muscular and fascial components and the influence of body posture on the function of the stomatognathic system including chewing and swallowing. The fascial system passively distributes tension, induced by mechanical stimulation, to the body muscles, and plays an important role in the effective transfer of tension induced by muscle contraction, which is essential for maintaining the contractile ability of muscles, suggesting that the actions of the muscles in the linkage can be mutually dependent, and may work as if they form a single system. The mechanisms underlying TMJ function and swallowing function may have a similar pattern, because orofacial and pharyngolaryngeal muscles of the stomatognathic system are closely related with muscle groups of the head and neck region. Moreover, impaired mobility of the extrinsic cervical muscles often disrupts the length-tension relationship of intrinsic pharyngolaryngeal and TMJ-related muscles, thereby reducing TMJ function and swallowing functions [14].

Connections between The trigeminal system and muscle-fascial chains

Another basic element of the correlation between SS and human posture is the existence of muscle-fascial chains (MFC). Fasciae are dense, fibrous connective tissues that interpenetrate and surround the human body to protect, nourish and hold organs in place. Three layers of fasciae exist: superficial, deep and visceral. Deep fasciae surround muscles, bones, nerves and blood vessels and are densely populated with myofibroblasts and several types of receptors (nociceptors, proprioceptors, mechanoreceptors, chemoreceptors, thermoreceptors). Myofibroblasts are fascial cells that are created as a response to mechanical stress and actively contract in a smooth, muscle-like manner [15].

The fascial system is important not only because it can passively distribute tension in the body muscles when mechanically stimulated, but also because it contains mechanoreceptors and possesses an autonomous contractile ability that influences the tension of the fasciae. The stimulation of intrafascial mechanoreceptors (mostly interstitial and Ruffini endings) causes the vegetative nervous system and the CNS to change the tension in intrafascial myofibroblasts and regulate fascial pre-tension. These tensions are transmitted along the MFC, thereby influencing the posture of the entire body [15].

An MFC is a group of muscles that are connected through the fasciae and are longitudinally positioned in the human body. They run in the same direction and overlap in a continuous chain, like tiles on a roof, which efficiently conducts tension. All of the muscles in the chain are mutually dependent and behave as if they were a single muscle. The existence of MFC may explain why disorders of the MM functions such as chewing and swallowing, can be transmitted to distal musculature [15].

Cervical posture may also be influenced by stimuli from the lower limbs. have compared cervical posture in lateral skull radiographs between healthy subjects and subjects who had anterior cruciate ligament injury of the left knee. They found that the latter group showed significant head extension compared to the healthy subjects. Injected a hydro-saline solution into the transverse processes of C7 and used electromyography to observe muscle contraction in zones distal from the spinal metamer where the injection was made. This seems to indicate that, because of the connections within the fascial system, change in any part of the body may create a disorder in another. For example, a contracted masseter muscle transmits its tension to homolateral SCM, and such connections may explain the influence of the SCM on mandibular movements. The MFC may also explain why an anterior cruciate ligament injury influences muscular electromyography activity of masseter, anterior temporalis, posterior cervicals, sternocleidomastoid, and upper and lower trapezius [16].

The masticatory system functions to preserve all the tissues in the entire system. In the non- diseased, semi-relaxed state, the teeth remain separated by the freeway space. This space is maintained by a balance in force between the opening and closing muscles of the jaw. The jaw-closing muscles are not truly relaxed to prevent gravity from allowing the mandible to drop and the mouth to gape open. As the teeth make contact, there is a reduction in contractile force by the mandibular elevators, particularly the temporalis, medial pterygoid, and masseter muscles, in order to reduce sustained force between opposing teeth [12].

The jaw-opening muscles, particularly the lateral pterygoid muscles, are activated just before teeth-to-teeth contact. These muscles act like an air brake to limit the force of the teeth in opposing jaws from biting too hard into each other. As the bite opens, the lateral pterygoid relaxes. Tooth-to-tooth contact initiates a swallowing reflex to remove the bolus from between the teeth and to eliminate the reason for mastication. These basic functions prolong the life of the periodontium and the health of the entire system certain conditions can cause an increase in sym- pathetic muscle tone. These conditions include stress, hormones, diet, drugs, trauma, and certain neuromuscular diseases. The increased tone affects the trigeminal centre in the brain, which stimulates the masticatory closing muscles causing masticatory muscle dystonia recognized as masticatory muscle hypertonicity and parafunction [13].

Masticatory Muscle Hypertonicity can be caused by variety of factors, such as stress, hormones, diet, drugs, trauma, and certain neuromuscular diseases, can lead to an increase in muscle tone, which results in masticatory muscle hypertonicity and parafunction [13].

Dystonia in the masticatory system is a disorder characterized by involuntary sustained muscle contractions resulting in repetitive movements or abnor-mal postures. It is also recognized as parafunctional clenching. If the temporalis muscles do not relax when the teeth come together, the lateral pterygoid in an attempt to separate the teeth remains contracted and is unable to relax. The lateral pterygoid muscles are unable to open the mandible because of the superior strength and tenacity of the temporalis. As lactic acid accumulates in the muscles, they start to cramp. Lateral pterygoid muscular pain symptoms are usually secondary to temporalis hypertonicity. When the temporalis is able to relax, symptoms from the lateral pterygoid in spasm usually disappear without any other specific treatment to the lateral pterygoid [14].

The pathological conditions attributed to masticatory muscle hypertonicity and parafunction

1- Limited mouth opening

2- Difficulty chewing

3- Dysphagia (difficulty swallowing)

4- Facial and pericranial muscle pain (nonspecific)

5- Flared upper anterior teeth

6- Masseteric hypertrophy

7 - Painful teeth

8- Scalloping of lateral border of tongue

9- Tender, sensitive teeth

10- Thermal sensitivity (hot and cold)

11- Tinnitus (ringing in the ears)

12- Tooth mobility

13- Wear facets gums

14- Cervical pain

15- Cervical erosion

16- Chipped anterior teeth

17- Delayed healing to periodontium after trauma [5]

The balance of the human body involves muscle activation that controlled by multisensory inputs (vision, vestibular, somatosensory) integrated in the central nervous system. Thus, neuroanatomical and functional connections between the masticatory and posture control system may explain role of masticatory muscles balance in controlling mouth opening and affection on body balance system. In a prestigious review study, the authors have suggested that tension in the stomatognathic system can contribute to impaired neural control of posture, and existence of numerous anatomical connections between the stomatognathic system's proprioceptive inputs and nervous structures are implicated in posture. Afferents from the periodontal apparatus, jaw muscles and temporomandibular joint converge on trigeminal nuclei together with sensory information from the cervical spine, while projection of the trigeminal neurons descend further down to C5, C6, C7, and to the vestibular nuclei these are involved in posture control. A significant alternation of postural control after unilateral truncular anesthesia of the mandibular nerve. Changes that result from a disturbance of the stomatognathic system may cause tonic neck and labyrinthine reflexes during an attempt to maintain posture. Change in the mandibular position alters centripetal information and posture control [8].

Stomatognathic system thought to be involved in postural control. The temporomandibular joint makes muscular and ligamentary connections to the cervical region, forming a functional complex cranio-cervico- mandibular system, and the extensive afferent and efferent innervations of stomatognathic system are reflected in the extensive representation of the orofacial district in the motor and sensory areas of the cerebral cortex [9].

Horizontal deviation in mandibular position interfered with stability of upright posture on an unstable platform, suggesting that changes in the stomatognsystem affect dynamic balance. An abnormality in the stomatognathic system might affect equilibrium function. Thus, maintenance of adequate occlusion need for not only original functions of mastication, pronunciation, swallowing but also equilibrium function [3].

The activity of the masticatory muscles demonstrated increased mouth opening in a forward head position as compared with the neutral or retracted head position, in healthy individuals. Furthermore, postural and deep cervical flexor training as well as cervical manual therapy has been shown to improve TMD signs and symptoms [11] long run treatment is sufficient to shut down the efferent response from spindle cells within the muscles that are implicated in initiating and potentiat ing the sympathetic dystonic cycle. The effect of physiotherapy program is to act as a governor on trigeminal innervation to the masticatory muscles. The obvious treatment goal is to reduce hypertonia via achieve a balance between weakness and hypertonic muscles sufficient to gain function [7] spastic hypertonia of masticatory muscles is an upper motor neuron syndrome that is caused after different types of cerebral damage such as traumatic brain injury, hypoxic brain damage, and stroke. It can cause serious complications after cerebral damages, because mouth opening is essential for oral feeding, oral hygiene, and speech [11].

The primary lesion leading to spasticity in individuals with CP lies in the central nervous system, leading to peripheral musculature abnormalities. Structural, histological, and functional changes have been observed in spastic peripheral skeletal muscles in these patients. Observation has verified that in the presence of muscle spasticity, a reduction in muscle capillarization occurs, together with lower oxidative capacity with an increased loss of muscle elasticity due to type I collagen accumulation in children with spastic CP. All these conditions could account for the weakness in the jaw-closing muscles observed in this study's subjects with spastic C.P [14].

Afferent inputs involved in postural adjustment can be modulated by many factors, such as mood state and anxiety. Restraint has commonly been used to investigate the effects of acute stress. Keeping deviated mandibular position and occlusal interference are putative stressors. Therefore, a deviation splint may induce excess muscular tension, resulting in derangement of muscle spindle-mediated movement. This affects the antigravity muscles involved in the maintenance of body balance. It is also possible that stress associated with the deviated mandibular position triggers laterality in cervical sympathetic nerve activity and subsequent laterality of blood flow in the inner ear and brainstem thereby affecting equilibrium [4].

There are three main types of childhood hypertonia: spasticity, dystonia, and rigidity. Spasticity is a velocity-dependent increase in resistance to movement of a muscle when it is passively stretched. It results from an interruption of the descending motor pathways that normally release GABA within the spinal cord. Common causes of spasticity include cerebral palsy and traumatic brain injury. Other causes include stroke, meningitis, and anoxic encephalopathy [13].

Dystonia refers to involuntary, stereotypic patterns of limb movement with associated hypertonia that end in a fixed posture with sustained muscle contractions of a rigid nature (lead-pipe resistance to movement). When the limb is moved passively, the tone tends to decrease.

Rigidity in children has been defined as the resistance to externally imposed joint movement that is present even at very low rates of movement and is not velocity dependent. Simultaneous co-contraction may be present as well as resistance to alteration in the direction of movement. No patterns of involuntary movement are seen in association with voluntary distal movement in a limb, and the limb does not tend to return to a fixed posture or extreme angle. Mixed hypertonia can also be seen in children; this term refers to hypertonia in a limb that has elements of spasticity and dystonia or other forms of non-velocity-dependent hypertonia.

Spasticity is velocity dependent: A key feature of spasticity is its tendency to increase as the rate of muscle stretching increases. Repeated movement in a muscle will also then lead to increased spastic hypertonia.

Rigidity is not velocity dependent: The resistance to passive movement in a muscle with rigidity is present regardless of the rate of the movement.

Dystonia is a movement disorder: Dystonia is an involuntary contraction in a muscle that is associated with a voluntary movement. Dystonia typically has a twisting or distorting feature, and its intensity can fluctuate over time [16].

The masticatory muscle spindle and plays a physiological role in locating the mandible and regulating motion. Antigravity muscles are literally important to maintain posture. A muscle functional evaluation in antigravity performance, the masseter muscle is evaluated next to soleus muscle and erector spinae muscles with assessment similar to medial head of gastrocnemius muscle and abductor hallucis muscle. The masseter muscle is believed to be involved in a major role of antigravity muscle. Abnormal afferent impulses caused by installation of a deviation splint may affect the inner ear labyrinth, which is responsible for equilibrium, and interfere with the maintenance of dynamic balance [3].

The anatomical positioning of the cranium, which is large in weight, over the legs and spinal column in the upright posture characteristic of human results in a high center of gravity and some degree of instability. The erect position of the head is maintained by a balanced tension between craniocervical bones, myofascial structures and dental occlusion. And the upper cervical spine is the mediator between head and trunk and forms an anatomically and functionally interrelated system. Masticatory muscles, including the neck muscles, are involved in maintaining head stability [8].

Conclusion

Specialized stomatognathic alignment exercise program with traditional physiotherapy program should be considered in improvement of masticatory muscles motor control and functional abilities of the TMJ in hemiplegic cerebral palsy children.

References

1. Schimmel M, Leemann B, Christou P, Kiliaridis S, Schnider A, et al. (2011) Oral health-related quality of life in hospitalised stroke patients. Gerodontology 28: 3-11.
2. van den Engel-Hoek L, de Swart BJ, Erasmus CE, de Groot IJ (2008) Is head balance a major determinant for swallowing problems in patients with spinal muscular atrophy type 2? J Child Neurol 23: 919-921.
3. Olmos SR, Kritz-Silverstein D, Halligan W, Silverstein ST (2005) The effect of condyle fossa relationships on head posture. Cranio 23: 48-52.
4. Iwatsuki H, Ikuta Y, Shinoda K (2001) Deep friction massage on the masticatory muscles in stroke patients increases biting force. J Phys Ther Sci 13: 17-20.
5. Cha TH, Oh DW, Shim JH (2010) Noninvasive treatment strategy for swallowing problems related to prolonged nonoral feeding in spinal muscular atrophy type II. Dysphagia 25: 261-264.
6. Edmiaston J, Connor LT, Loehr L, Nassief A (2010) Validation of a dysphagia screening tool in acute stroke patients. Am J Crit Care 19: 357-364.
7. Tingey EM, Buschang PH, Throckmorton GS (2001) Mandibular rest position: a reliable position influenced by head support and body posture. Am J Orthod Dentofacial Orthop 120: 614-622.
8. Logemann JA (2007) Swallowing disorders. Best Pract Res Clin Gastroenterol 21: 563-573.
9. Mann G, Hankey GJ (2001) Initial clinical and demographic predictors of swallowing impairment following acute stroke. Dysphagia 16: 208-215.
10. Bracco P, Deregibus A, Piscetta R (2004) Effects of different jaw relations on postural stability in human subjects. Neurosci Lett 356: 228-230.
11. Wright EF, Domenech MA, Fischer JR Jr (2000) Usefulness of posture training for patients with temporomandibular disorders. J Am Dent Assoc 131: 202-210.
12. Oh DW, Jeon HS, Kwon OY, You SH, Park SB, et al. (2008) Effect of stomatognathic alignment exercise on temporomandibular joint dysfunction associated with ankylosing spondylitis: a pilot study. J Back Musculoskeletal Rehabil 21: 211-217.
13. Mann G, Hankey GJ, Cameron D (1999) Swallowing function after stroke: prognosis and prognostic factors at 6 months. Stroke 30: 744-748.
14. Oh DW, Kim KS, Lee GW (2002) The effect of physiotherapy on post-temporomandibular joint surgery patients. J Oral Rehabil 29: 441-446.
15. Finestone HM (2000) Safe feeding methods in stroke patients. Lancet 355: 1662-1663.
16. Cuccia A, Caradonna C (2009) The relationship between the stomatognathic system and body posture. Clinics (Sao Paulo) 64: 61-66.