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Original Article

A comparison of outcomes of asymmetry in infants with congenital muscular torticollis according to age upon starting treatment

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Abstract. [Purpose] The purpose of this study was to compare the outcomes of asymmetry in infants with congenital muscular torticollis (CMT) according to the age when treatment was started. [Subjects and Methods] 102 infant CMT patients under the age of 6 months were selected. The subjects were divided into a group that started treatment before six weeks (n=55) and a group that started treatment after six weeks (n=47). Asymmety was evaluated by determining the difference in the thickness of the two sternocleidomastoid muscles (DTSM) using ultrasonography, head tilt (HT) based on a physical examination, and the torticollis overall assessment (TOA). Patients received ultrasound and massage therapy for 30 minutes, in conjunction with passive stretching exercises, 3 times a week. [Results] Following the intervention, the DTSM, HT and TOA showed significant differences in the two groups. The DTSM of the group that started treatment before six weeks was significantly better than that of the group that started treatment after six weeks. [Conclusion] The results of this study suggest that early intervention is more effective than later intervention.

Key words: Congenital muscular torticollis, Sternocleidomastoid muscles, Head tilt

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INTRODUCTION

Congenital Muscular Torticollis (CMT) is a congenital deformity characterized by unilateral shortening of the sternocleidomastoid muscle resulting in lateral inclination of the neck associated with contralateral torsion[1)]. It is synonym with fibromatosis colli, wry neck, and twisted neck[2)].

CMT is a prevalent disease similar to congenital dislocation of the hip joint next to the talipes varus. The frequency of wry neck is between 0.2–2.0%[3)]. In the latest research, asymmetric restriction of the cervical range of motion occurred in one in every 6 infants in a group of 102 healthy infants[4)].

There are many secondary diseases of CMT such as brachial plexus damage, limb deformity and early developmental delay[5)], facial asymmetry, which influences function and appearance[6)], and temporomandibular joint (TM joint) disorder[7)]. Sternocleidomastoid (SCM) and TM joint hypofunction on the affected side and the weakened masticatory muscles influence the formation of articulation[7)].

The most ideal period of treatment for CMT is between the age of 1 and 4[8)]. In prospective and retrospective studies of the passive cervical range of motion, the success rate appeared to be 61–99% when the intervention began prior to the age of 1. Age is reported to be an important factor that influences the treatment outcome[3, 9, 10)]. In the previous studies, the prognosis was most favorable for 3-month-old babies. The prognosis is comparably good if the correction is performed within 1

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year[11–13].

The age of intervention greatly influences the possibility of achieving symmetric head posture[14–16]. With a longer delay, the cervical range of motion will gradually decrease and infant patients might require 9–10 months of intervention if the intervention begins more than 6 months after birth[17].

Therefore, this study was performed to compare the outcomes of asymmetry in infants with CMT according to the age when treatment was started (treatment starting before six weeks and treatment starting after six weeks), and to provide basic data through analysis of the efficacy of early physiotherapy intervention in infants with CMT according to the age upon starting treatment.

SUBJECTS AND METHODS

All infants with clinically suspected CMT who visited the Seoul K Medical Center as outpatients between January 2007 and May 2013 were considered for inclusion in this study. A total of 102 infants (62 boys and 40 girls) met the inclusion criteria, and their parents agreed to a conservative treatment program. The inclusion criteria were: an age of less than 6 months, a palpable neck mass or limited neck motion, and receipt of informed consent from the parents or caregivers. The exclusion criteria were a history of other diseases or disorders, congenital anomalies of the cervical spine, apparent ocular torticollis, or neurologic or auditory problems. The present study was approved by the Sahmyook University Institutional Review Board (SYUIRB2014-069) and the objective of the study and its requirements were explained to the subjects, and all participants provided written parental consent, in accordance with the ethical principles of the Declaration of Helsinki.

The parents of each infant were required to provide their written consent to the examination of the patients' medical records as a prerequisite for study inclusion. The clinical characteristics of the participants, including gender, mode of delivery, direction of torticollis, gestation period, birth weight, and presence of lesions such as spinal neurological lesions of the hip joint, were evaluated and recorded. The general characteristics of the infants with CMT are shown in Table 1.

We recruitment subject treatment started before 6 weeks and after 6 weeks among CMT who visited the Seoul K Medical Center as outpatients. The subjects were divided into a group that started treatment before six weeks (n=55) and a group that started treatment after six weeks (n=47). Three times a week, the infants with CMT received therapeutic ultrasound, massage therapy, and manual stretching exercises for 30 minutes along with passive stretching exercises. The most common type of electrotherapy is ultrasound and therapeutic ultrasound was delivered to the infants using a 1 cm^2 transducer at an intensity of 0.5–1.0 W/cm^2 for 3 minutes. Massage therapy was performed for 5–7 minutes using the effleurage method with oil to increase muscle stretching and blood flow. A passive stretching program was employed to increase the range of neck rotation on the affected side and involved lateral neck flexion to the contra-lateral side, which was held for 10–30 seconds and repeated 10 times[18]. The physical therapist provided the interventions and evaluation. While the interventions, we not allowed to do home exercise.

The data for all the subjects were analyzed to determine the differences in the thickness of the two sternocleidomastoid muscles (DTSM), head tilt (HT), and torticollis overall assessment (TOA).

DTSM was evaluated using a LOGIQ S8 ultrasound scanner (General Electric, 2012, Korea) with a 6–12 MHz linear array transducer. Ultrasonography as an indicator of muscle activity is a non-invasive method to measure the thickness of the muscle and is a reliable tool. Ultrasonography of the SCM muscles was performed by two physicians in order to confirm the existence of a neck mass or hypertrophy of the SCM muscle; the thicknesses of the SCM muscles were measured in longitudinal and transverse views. The infants were examined in the supine position, with slight extension of the neck from gentle rotation of the head to the opposite side[19]. SCM muscle thickness was recorded in millimeters (mm).

Still photography was used to evaluate HT, as suggested by Rahlin[20], and the amount of an infant's habitual lateral flexion in the supine position was recorded as HT. This method involves positioning the infant in a supine state and providing a

Table 1. General characteristics of the participants (N=102)

Categories	Type	Treatment started before six weeks (n=55)	Treatment started after six weeks (n=47)
Gender (%)	Male infants	35 (63.6)	27 (57.4)
	Female infants	20 (36.4)	20 (42.6)
Type of delivery	Natural delivery	47 (85.5)	34 (72.3)
	Cesarean delivery	8 (14.5)	13 (27.7)
Direction of torticollis (mm)	Right	29 (52.7)	25 (53.2)
	Left	26 (47.3)	22 (46.8)
Gestation period (week)		39.3 (1.1)	39.3 (1.3)
Birth weight (kg)		3.4 (0.4)	3.3 (0.5)

n (%) or mean (SD)

visual stimulus at the midline, without making any additional effort to place the head in the midline position. To evaluate HT, two lines were drawn on printed photographs, one across the infant's eyes and the other through the superior aspect of the acromion processes (at the top of the lateral third of the shoulder). These lines were extended until they intersected, and the acute angle between the two lines, which represents the spontaneous lateral tilt from the midline exhibited by an infant, was measured to the nearest degree with a protractor[20]. To minimize measurement error, HT was independently evaluated by three physical therapists with more than 4 years of experience.

TOA was used to evaluate rotation deficits (degrees), side flexion deficits (degrees), craniofacial asymmetry, residual bands (none, lateral, cleido, or sternal), HT (none, mild, moderate, severe), and subjective assessments by parents (cosmetic and functional) to yield an overall score. In the final assessment, the overall results were rated as excellent, good, fair, or poor using a scoring system based on both subjective and objective criteria[11].

All statistical analyses were performed using SPSS, version 18.0. The general characteristics are presented as frequencies and percentages, with average and standard deviations also provided. The Paired t-test was used for analysis of changes in independent variables between before and after the training. The independent t-test was used for analysis of changes in dependent variables between groups. The significance threshold was set to $p<0.05$.

RESULTS

Differences in DTSM, HT and TOA after the intervention are shown in Table 2. The DTSM, HT and TOA showed significant differences in the two groups. DTSM only showed significant differences between the two groups after the intervention.

DISCUSSION

Congenital muscular torticollis (CMT) is a relatively common neck deformity in infancy, with a reported incidence of 0.3–1.9%[21]. According to Tatli et al.[22], the recovery rate is higher for the group of children that receive an intervention within 6 weeks of birth compared to the group of children that receive an intervention after 6 weeks. Early intervention has a faster effect than later intervention. The authors also reported that if the intervention is begun within 1.5 months, 98% normal cervical range of motion can be achieved[17].

In this study, the DTSM, HT and TOA showed significant differences in the group that started treatment before six weeks and the group that started treatment after six weeks. DTSM only showed significant differences between the two groups after the intervention. The infants with CMT received therapeutic ultrasound, massage therapy, and manual stretching exercises for 30 minutes along with passive stretching exercises. And early intervention for a child with CMT at less than 1 month of age yields a 98% success rate by 2.5 months of age, with the infant achieving near normal range of motion.

The ultimate goal of physical therapy for CMT children is to minimize abnormal voluntary placement and movement and to normalize the cervical range of motion[23]. Since the success rate of conservatory treatment for infant patients within 12 months after birth is closely related to the age of the patients and the time of enforcement of exercise treatment, active and passive extensional movements during this period can be a very effective means of treatment[24]. Cheng et al.[25] and Persing et al.[26] claimed that manual stretching is beneficial even in children with severe contracture. However, passive extension sometimes causes micro damage to the cervical soft tissue. In such situations involving pain, passive manipulation to increase the range of motion and manual stretching is not recommended, because micro damage in the soft tissue eventually decreases the range of motion and brings about fibrosis proliferation[27].

Nevertheless, in previous studies, the most common treatment for SCM mass and muscular torticollis is manual extensional movement. The advantage of this treatment is that there is no need to consider the intensity and technique when extending the neck to increase the passive range of motion, and passive cervical stretching can be applied to the baby while feeding them[28]. In the study by Cheng et al.[25], an accurate application of a protocol for manual extensional exercise by a skilled therapist resulted in a high success rate. According to existing studies on the application of manual extensional exercise, since there

Table 2. Comparison of outcomes of asymmetry within groups and between groups (N=102)

Parameters	Values				Change values	
	Treatment started before six weeks (n=55)		Treatment started after six weeks (n=47)		Treatment started before six weeks (n=55)	Treatment started after six weeks (n=47)
	Before	After	Before	After	Before-after	Before-after
DTSM (mm)	6.4 (2.6)	2.5 (1.7) ***	6.3 (3.2)	3.8 (3.4) ***	3.9 (2.4) **	2.5 (2.4)
HT (°)	13.0 (6.7)	2.3 (3.9) ***	14.3 (7.9)	3.8 (5.1) ***	10.6 (6.9)	10.6 (8.8)
TOA (score)	6.1 (3.7)	14.7 (2.3) ***	6.1 (3.3)	14.2 (2.4) ***	−8.6 (3.9)	−8.0 (2.9)

Values are means (SD). DTSM: difference in the thickness of the two sternocleidomastoid muscles; HT: head tilt; TOA: torticollis overall assessment, *p<0.05, **p<0.01, ***p<0.001

can be severe resistance from 3-month-old patients due to the pain and discomfort of manual extensional exercise, prolonged stretching with low intensity is better than a forcible method to effectively increase the range of motion[27].

Even though SCM masses reach a maximum size then gradually decrease and disappear and muscle tension also subsides in most childhood patients[25], fibrosis does not disappear in many portions of the SCM, remaining in some childhood patients and causing secondary problems. If the restriction of movement range persists and the head position and posture including motion remain asymmetric after interventions for the infant patients, continuous physical therapy is the optimal method[24]. Also, if abnormal tension and mass in the SCM remains after long term conservative treatment, surgical treatment must be considered[18, 25].

The conclusion of treatment is achieved after gaining a symmetric cervical range of motion in terms of the functional aspect for infant patients, with unapparent head inclination, and symmetry of the SCM with thickness less than 10%[3].

The typical compensation action among the characteristics of torticollis in children is tension in the upper trapezius[29]. According to previous studies, while the shape of the upper neck is formed by the fibers of the SCM, the shape of the lower neck is formed by the fibers of the upper trapezius. This is why there is a possibility of lesion formation in the ipsilateral upper trapezius, which co-contracts with the affected SCM. Some infant patients lift the affected shoulder to place their head in the center. CMT children experience disproportionate development of the musculoskeletal system starting in the uterus until 1 year after birth, and have abnormal movement planning and practice due to dyscinesia.

The general opinion on the treatment outcome for infants with congenital muscular torticolis is related with ROM and the age when treatment is started. Retrospective and prospective studies on cervical AROM exercise intervention started before the age of 1 confirmed 61 to 99 percent successful treatment outcomes, thus demonstrating a direct influence on the entire intervention[3, 11, 18, 25]. In addition, Öhman et al.[14] contended that the age when intervention is started has a definite effect on the acquisition of symmetric cervical posture and therefore recommends early intervention. To conclude, early intervention shortens the intervention period and secures the best result[11, 17, 24, 25].

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