Journal of Back and Musculoskeletal Rehabilitation -1 (2017) 1–7 1
DOI 10.3233/BMR-169746
IOS Press

A randomized controlled study on the efficiency of soft tissue mobilization in babies with congenital muscular torticollis

Hilal Keklicek* and Fatma Uygur
Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Hacettepe University, Ankara, Turkey

Abstract.
BACKROUND: Soft tissue mobilization techniques (STM) are used in clinical practice in treatment of congenital muscular torticollis(CMT).However, little is known about its effectiveness.
OBJECTIVES: To investigate whether using STM to manage CMT in babies with mild to moderate head tilt was effective or not.
METHODS: Twenty-nine babies with CMT aged between 0-6 months, who had a head tilt from 5 to 20 degrees were allocated to two groups. Both groups received a baseline home program (positioning, handling strategies, stretching and strengthening exercises, environmental adaptations). The study group (SG) also received STM three times a week. Babies were evaluated initially, at six weeks, at 12 weeks and for follow-up at 18 weeks with muscle function scale, head tilt and range of motion for neck lateral flexion and rotation.
RESULTS: Both groups showed significant improvement in all measured parameters ($p < 0.05$). In comparison of groups, there were differences at six weeks in favor of the SG for neck rotation (0.001) and head tilt (= 0.006); but at 12 weeks and follow up, there were no longer any differences between the groups in any of the measured parameters.
CONCLUSIONS: STM techniques are effective in getting faster positive results in the treatment of CMT.

Keywords: Congenital muscular torticollis, pediatric physiotherapy, musculoskeleteal manipulations

1. Introduction

Congenital muscular torticollis (CMT) is a musculoskeletal problem commonly seen in babies. The stiff sternocleidomastoideus muscle bends the neck to the same side and rotates the neck to the opposite side [1,2]. Soft tissue mobilization (STM) is a technique, known as muscle mobilization or fascial mobilization; commonly used in clinical practice for management of tight muscles. It is believed that the technique is useful and safe for babies who have musculoskeletal problems such as CMT [3,4].

Although there are various studies on the effectiveness of therapeutic methods for the treatment of CMT [5]. There are no randomized controlled studies investigating the effectiveness of soft tissue mobilization in babies with CMT. This study was carried out with the aim of determining whether using soft tissue mobilization to manage CMT in babies with mild or moderate head tilt was effective in enhancing symmetric posture of the head and neck.

2. Methods

The university ethical committee approved our study. Caregivers gave informed consent (application number is G014/14) for participation to the study and permission for photographs to be taken. Trial number is

*Corresponding author: Hilal Keklicek, Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Hacettepe University, Ankara, Turkey. Tel.: +90 312 3051576; Fax: +90 312 3052012; E-mail: kekelicek@hacettepe.edu.tr.

NCT02403011. Thirty-six babies with CMT who were referred to receive physiotherapy at the department of Physiotherapy and Rehabilitation of Hacettepe University were assessed for eligibility. Following referral from a pediatrist, babies aged between 0–6 months were enrolled to the study if they met the inclusion criteria which was having a head tilt from 5 to 20 degrees. Subjects were excluded from the study if they had other health problems such as vertebral anomalies or neurological deficits.

The subjects were randomly allocated into the control (CG) or study group (SG) by utilizing opaque sealed envelopes after receiving the baseline home program. While the CG received the home program, the SG was given the baseline home program plus soft tissue mobilization carried out by a physiotherapist three times a week. This study was planned as a randomized controlled study.

2.1. Assessments

Every child was evaluated with i) muscle function scale [6], ii) photographing method [7], iii) arthrodial protractor [8]. The Muscle Function Scale (MFS) describes an infant's muscle function in the lateral flexors of the neck through ordered categorical scores [6], The MFS assesses the neck lateral flexor strength by using head correcting reaction (righting reaction). The therapist holds the baby's trunk in upright position, then inclines the baby to the affected side as long as the baby corrects the head position. If the infant holds the head below the horizontal line a score of 0 is given, holding the head on the horizontal line is scored 1, holding slightly over the horizontal line is scored 2, holding high over the horizontal line is scored 3, and very high over the horizontal line is scored 4. The infant has to hold the head for at least 5 seconds on one level to achieve the score for that level otherwise is scored at the level below. Five is given if the baby can correct head position when held horizontal. Zero implies that the baby can not correct the head even when held vertical [6,8].

Head tilt was evaluated with the photographic method by using HumanBody 1.0 software. Baby lies supine while taking photo of baby's habitual head position. The angle between the two lines, connecting eyes pupils and connecting the acromions, is measured automatically by the software. The photographic method is a valid method for measuring severity of CMT [7].

Passive range of motion was evaluated with an arthrodial protractor. Baby lies in the supine position and caregiver stabilizes the shoulders to prevent compensatory movements. For lateral flexion therapist bends the neck to opposite side from the affected sternocleidomastoid muscle (SCM). For neck rotation, therapist rotates the neck to affected SCM and measures with an arthrodial protractor. It was shown that evaluating passive range of motion by means of an arthrodial protractor is reliable and can be used to determine the effects of treatment in infants with CMT [8]. Ninety degrees for neck rotation and the 60 degrees for lateral flexion were accepted as cure because, these angles were reported as reference values for neck range of motion in babies [9].

2.2. Interventions

Following the initial evaluation, caregivers (who were the parents and in fact mothers for all of the subjects) were given the same baseline home program which consisted of positioning the neck and head, handling strategies, stretching exercises, strengthening exercises according to babies neurodevelopmental level and environmental adaptations. One or two days following the first visit the caregivers were asked to come again and demonstrate how they handled the baby and managed the exercises and how they had carried out the recommendations and. what adaptations they had made, regarding the crib etc. The parents were reinformed as necessary.

All parents were educated regarding the following strategies:

The given recommendations were decreasing the time spent in a car seat. Lying and sleeping on the left and right side alternatively. When the baby is awake and under supervision, spending time in the prone position regularly. Placing colorful and sonorous toys or mirror on the affected side, and stimulating active rotation by communicating with the baby from this side. Positioning during breast feeding to stimulate active rotation to the affected side. *Righting reaction and active head rotation exercises* were prescribed in different positions according to the baby's neurodevelopmental level and muscle function. *Stretching exercises* were given with handling strategies. For example, while carrying the baby lying on the affected side, caregivers can stretch the lateral neck flexors or trunk muscles at the same time. Also while holding the baby in the upright position, caregivers can put their right cheek to baby's left cheek – or the exact opposite of this – and stabilize the baby's right

Fig. 1. First phase of soft tissue mobilization for SCM muscle.

Fig. 2. Second phase of soft tissue mobilization for SCM muscle.

shoulder, thus can stretch the components limiting passive rotation. Stretching exercise consisted of 30 s stretching and 10 s resting periods and were carried out five times for each set.

All exercises, were applied after each diaper change and handling strategies were spread throughout the day. Also, caregivers were informed and encouraged about connecting with the therapist by intelligent phone application two or three times a week such as sending photos or videos for enhancing the adherence to the home program. Caregivers also sent photos showing home arrangements.

After parents were given the same home program, they were allocated to the control or study group with opaque sealed envelope randomization. Participants were assigned to the SG ($n = 14$) or CG ($n = 15$). Therapy was carried out by HK. Evaluation of torticollis was carried out before randomized allocation and following the treatment by FU. The envelopes were opened by HK only after all baseline assessments was completed and home programs were given for enrolled subjects. There could not be a placebo effect because the subjects were babies. The SG received SMT three times a week for 12 weeks.

In our study SMT was used to release the neck muscles and fascia because it is believed to be safe even for fragile tissues of babies and is widely used in clinical practice and can be modified according to the tissue situation [3,4]. The technique has three phases. The first passive mobilization phase' is applied by gentle but tight gripping of the SCM muscle with two or three fingers below the muscle origo and the muscle is mobilized rhythmically in the antero-posterior direction (Fig. 1). Second phase is mobilization with stretching. The therapist gently grips and withholds the muscle

Fig. 3. Third phase of soft tissue mobilization for SCM muscle.

and slightly stretches it and waits in this position, then mobilizes the muscle in the antero-posterior direction (Fig. 2). Thirdly, gently continuing to hold the muscle, the baby is encouraged to do active cervical rotation to the affected side by means of catching the baby's attention with colored and sonorous toys (Fig. 3).

2.3. Data analysis

Friedman tests were conducted to test whether there was significant change in time-dependent analyses. The Wilcoxon test was used to test within group changes. Bonferroni correction was utilized for post-hoc analyses of time-dependent results and α value was calculated as 0.0125. The two groups were compared using Mann Whitney U test. An overall %5 type-I error level was used to infer statistical significance.

2.4. Sample size and power analyses

Habitual head tilt assessment which was the prime outcome measure was used for calculating sample size. Effect size was described with post hoc analysis as 1,67179 by using group means and standard deviations. Power of the study was calculated from the GPower 3.0.10 analysis program and was found to be higher than 90% with a total of 29 participants for both groups, power alpha level at 0.05. Intention to treat analyses was carried out to manage the missing data; we used the participant's last outcomes at the time they left the study.

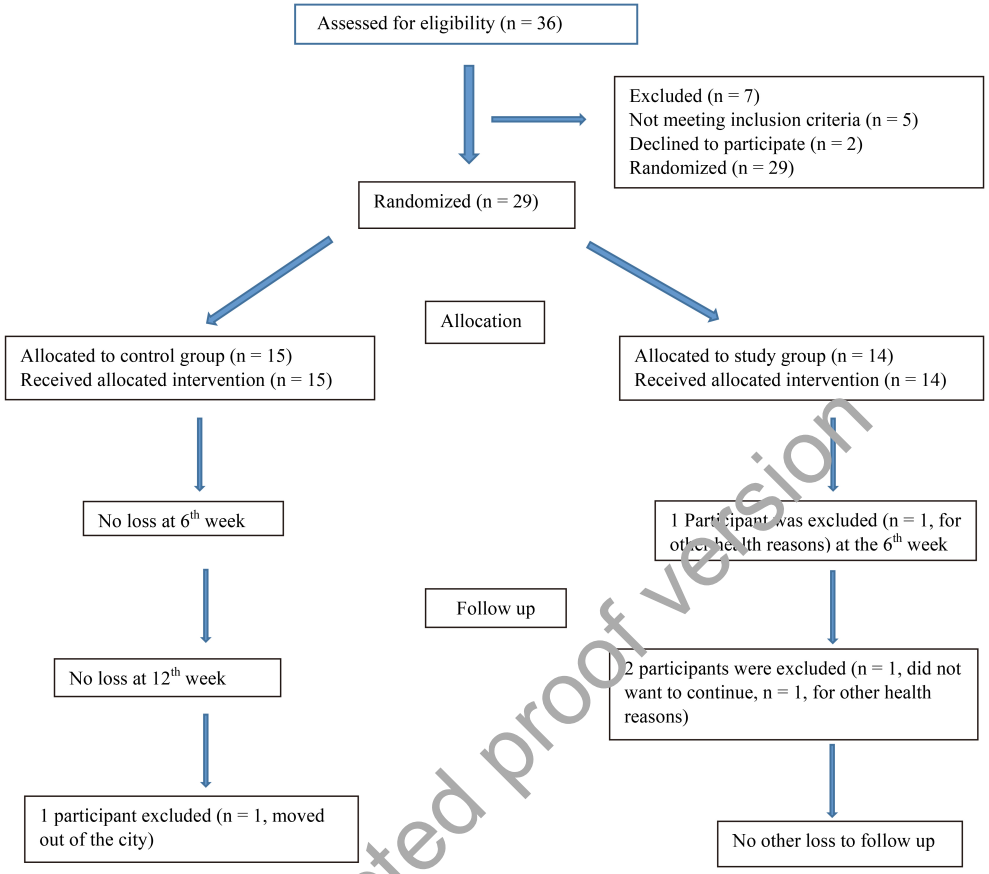
3. Results

Both groups were evaluated four times; initially before randomized allocation, at 6 weeks and 12 weeks during the treatment period and at 18 weeks after initial evaluation, in other words, 6 weeks after treatment was ended for follow up. At these weeks the baseline home program was revised and continued as necessary. Flow diagram is seen in Table 2.

The gender of the control group was 6 girls and 9 boys; the age was 103 $\pm$ 42 days, birth weight was 3283 $\pm$ 407.31 grams, gestational time was 38.4 $\pm$ 1.29 weeks. The gender of the study group was 7 girls and 7 boys; the age of was 97 $\pm$ 42 days, birth weight was 3330.42 $\pm$ 486.35 grams, gestational time was 38.6 $\pm$ 1.82 weeks. Demographic characteristics of the two groups were similar ($p > 0.05$).

When the control and study groups were compared initially there was no difference between the groups re-

Table 1
Flow diagram of the study



garding habitual head tilt, neck lateral flexion and rotation and MFS parameters ($p > 0.05$). After six weeks of treatment there were significant differences between CG and SG in habitual head tilt ($p = 0.001$), neck rotation ($p = 0.001$) in favor of the SG. After 12 weeks differences between CG and SG were eliminated. This continued at the 18th week evaluation. Intragroup analyses showed that there were significant differences in both groups in time-dependent analyses ($p < 0.005$). Means and standard deviations of all evaluations are summarized in Table 2.

3.1. Discussion

The results of this study have shown that physiotherapeutic intervention via soft tissue mobilization is effective in the treatment of congenital muscular torticollis and accelerates recovery.

Manual therapy is used by physiotherapists to relax tight muscles in clinical practice [10,11]. In a 2014 study, investigators reported that using soft tissue mobilization increased range of motion and helped in reducing tightness, promoted myofascial changes and was useful in reducing pain [12]. Godges at al. implied that STM was the application of specific and progressive manual forces with the intent of promoting changes in the myofascia, allowing for elongation of shortened structures [13]. Laudner et al. also recommended STM to enhance shoulder motion [14]. Gentle manual therapeutic techniques have been reported to be safe in children [10,11]. However effectiveness of soft tissue techniques or other manual therapeutic methods have not been established for infants because there are not enough controlled randomized trials related to this method. Bjurberg et al. have released a review identifying no risk of complications associated with the treatment, but strength of evidence is low [10]. Haugen at al. indicated that in patients with moderate symptoms related to torticollis, the short-time effect of manual therapy in addition to physiotherapy was not significantly better than physiotherapy alone [11]. When manual therapy is used for infants mobilization

Table 2
Means and standard deviations, and results of analyses

Assessments	Control group	Study group	Mann Whitney U test	
	Mean ± standard deviation	Mean ± standard deviation	z	p
Muscle Function Scale 1	1.33 ± 0.97	0.78 ± 0.89	−1.488	0.137
Muscle Function Scale 2	2.66 ± 0.72	3.14 ± 0.77	−1.596	0.111
Muscle Function Scale 3	4.73 ± 0.45	4.64 ± 0.74	−0.088	0.93
Muscle Function Scale 4	4.73 ± 0.45	4.64 ± 0.74	−0.088	0.93
Head Tilt 1	9.51 ± 1.75	11.81 ± 3.8	−1.703	0.089
Head Tilt 2	**4.95 ± 2.48**	**1.69** ± 1.15	**−3.364**	**0.001**
Head Tilt 3	0.42 ± 0.78	0.52 ± 0.62	−0.772	0.44
Head Tilt 4	0.21 ± 0.45	0.08 ± 0.32	−0.873	0.382
Neck Rotation 1	39.20 ± 11.55	37.28 ± 11.44	−0.416	0.667
Neck Rotation 2	**62.26** ± 8.96	**82.07** ± 7.77	**−4.237**	**0.001**
Neck Rotation 3	86.13 ± 4.30	88.28 ± 2.26	−1.187	0.235
Neck Rotation 4	88.20 ± 2.90	88.92 ± 1.63	−0.477	0.633
Neck Lateral Flexion 1	34.33 ± 4.32	31.07 ± 7.24	−1.174	0.24
Neck Lateral Flexion 2	44.93 ± 5.18	46.78 ± 4.64	−0.940	0.347
Neck Lateral Flexion 3	50.66 ± 1.75	51.78 ± 2.48	−1.383	0.167
Neck Lateral Flexion 4	52.66 ± 4.16	53.21 ± 3.72	−0.593	0.553

1: Initial evaluation, 2: Evaluation at six weeks, 3: Evaluation at 12 weeks, 4: Follow-up evaluation.

techniques are preferred because when compared to manipulations mobilizations are easier, cooperation of the subject is not required, there is no necessity to use sudden force and intensity; application can be gradually enhanced or reduced according to the soft tissues response during treatment [3,4].

Previous studies implied that conservative treatment methods that include passive stretching, positioning for active movement away from the tightness, handling strategies and parent education for home programs are effective in treatment of congenital muscular torticollis [15–19]. As in previous studies, our study showed that the home program which consisted of positioning the neck and head, handling strategies, stretching exercises, strengthening exercises according to babies neurodevelopmental level and environmental adaptations are effective in managing congenital muscular torticollis. STM augments the therapy and this group provided better results at six weeks in assessments of CMT. This result is in concordance with Ohman's report [15]. Although 6^{th} week assessments showed better improvement in the SG, the results of the 12^{th} and 18^{th} weeks were similar for both the CG and SG.

The study also showed that using intelligent phone applications had positive effects on parents to adherence to the home program.

There are some limitations in the study. The assessor FU was not totally blind to the nature of the study and although blind to which group the babies were assigned to, carried out some assessments with the help of HK. Therefore total blindness was not achieved and elimination of bias was not absolute. Secondly, one of the evaluation criteria, namely muscle function scale was not appropriate to evaluate strength related to muscle function for babies who were younger than 2 months of age. The results are valid for mild and moderate degree CMT and should not be generalized a for severe cases where soft tissue mobilization could be more effective.

4. Conclusion

A comprehensive home program and STM are effective in treating CMT. Faster improvement is possible when soft tissue mobilization is carried out by the physiotherapist three times a week in addition to a home program in the treatment of CMT. However, the effects of home program and home program plus soft tissue mobilization level out at 12 weeks.

Conflict of interest

The authors report no conflict of interest.

References

[1] Rogers GF, Oh AK, Mulliken JB. The role of congenital muscular torticollis in the development of deformational plagiocephaly. Plast Reconstr Surg. 2009; 123(2): 643-652.

[2] Hollier L, Kim J, Grayson BH, McCarthy JG. Congenital muscular torticollis and the associated craniofacial changes. Plast Reconstr Surg. 2000; 105(3): 827-835.

[3] Biedermann H. Manual therapy in children: Proposal for an etiologic model. J Manipulative Physiol Ther. 2005; 28: 211. e1-211.e15. 2.

[4] Brand PLP, Engelbert RHH, Helders PJM, Offringa M. Systematic review of effects of manual therapy in infants with kinetic imbalance due to suboccipital strain (KISS) syndrome. J Manual Manipulative Ther. 2005; 13: 209-214.

[5] Suhr Maureen C. Oledzka Magdalena. Considerations and intervention in congenital muscular torticollis. Curr Opin Pediatr. 2015; 27(1): 75-81.

[6] Öhman, A, Staffan Nilsson M, Beckung E. Validity and reliability of the muscle function scale, aimed to assess the lateral flexors of the neck in infants. Physiother Theory Pract. 2008; 25(2): 129-137.

[7] Rahlin M, Sarmiento B. Reliability of still photography measuring habitual head deviation from midline in infants with congenital muscular torticollis. Pediatr Phys Ther. 2010; 22(4): 399-406.

[8] Cheng JC, Wong MW, Tang SP, Chen TM, Shum SL, Wong EM. Clinical determinants of the outcome of manual stretching in the treatment of congenital muscular torticollis in infants. J Bone Joint Surg Am. 2001; 83(5): 679-687.

[9] Öhman AM, Beckung ER. Reference values for range of motion and muscle function of the neck in infants Pediatr Phys Ther. 2008; 20(1): 53-58.

[10] Bjurberg KG, Myrhaug HT, Reinar LM. Diagnostikk og behandling av spedbarn med holdnings asymmetri og nakkeleddsinduserte funksjonsforstyrrelser. Oslo: Norwegian Knowledge Centre for the health Services Report No: 17-2009; ISBN 978- 82-8121-279-4 ISSN 1890-1298, 2009.

[11] Haugen EB, Benth J, Nakstad B. Manual therapy in infantile torticollis: a randomized, controlled pilot study. Acta Paediatr. 2011; 100(5): 687-690.

[12] Dajah A, Bweir S. Soft Tissue Mobilization and PNF Improve Range of Motion and Minimize Pain Level in Shoulder Impingement. J Phys Ther Sci. 2014; 26(11): 1803.

[13] Godges JJ, Mattson-Bell M, Thorpe D, Shah D. The immediate effects of soft tissue mobilization with proprioceptive neuromuscular facilitation on glenohumeral external rotation and overhead reach. J Orthop Sports Phys Ther. 2003; 33: 713-718.

[14] Laudner K, Compton BD, McLoda TA, Walters CM. Acute effects of instrument assisted soft tissue mobilization for improving posterior shoulder range of motion in collegiate baseball players. Int J Sports Phys Ther. 2014; 9(1): 1.

[15] Ohman AM, Nilsson S, Beckung ER. Stretching treatment for infants with congenital muscular torticollis: physiotherapist or parents? A randomized pilot study. Phys Med Rehabil. 2010; 2: 1073-1079.

[16] Emery C. The determinants of treatment duration for congenital muscular torticollis. Phys Ther. 1994; 74(10): 921-929.

[17] Cheng JC, Wong MW, Tang SP, Chen TM, Shum SL, Wong EM. Clinical determinants of the outcome of manual stretching in the treatment of congenital muscular torticollis in infants: a prospective study of eight hundred and twenty-one cases. J Bone Joint Surg Am. 2001; 83(5): 679-687.

[18] Chon SC, Yoon SI, Yoo JH. Use of the novel myokinetic stretching technique to ameliorate fibrotic mass in congenital muscular torticollis: an experimenter-blinded study with 1-year follow-up. J Back Musculoskeletal Rehabil. 2010; 23: 63-68.

[19] Celayir AC. Congenital muscular torticollis: early and intensive treatment is critical. A prospective study. Pediatr Int. 2000; 42(5): 504-507.