

# Immediate Effects on Dorsiflexion of Gong's Mobilization Applied to Ankle Joints

MISUK CHO, PhD, PT<sup>1)</sup>, WONTAE GONG, PhD, PT<sup>1)</sup>, SUNGBUM JU, PhD<sup>2)</sup>

<sup>1)</sup> Department of Physical Therapy, Korea Nazarene University: Wolbong Ro 48, Seobuk-gu, Cheonan-Si, Chungcheongnam-do, 330-718 Republic of Korea.

TEL: +82 41-570-4286, FAX: +82 41-570-7925, E-mail: owntae@hanmail.net

<sup>2)</sup> Major in Exercise Therapy, Department of Health and Physical Education, Kochi University

**Abstract.** [Purpose] The objective of this study was to verify the immediate effects of Gong's mobilization on the ankle dorsiflexion range of motion (ROM). [Subjects] The subjects of this study were 40 health adult males and females who were divided equally into a Gong's mobilization group (Gong's group) and mobilization with movement group (MWM group). [Methods] Gong's mobilization and MWM were implemented about 10 times. The ankle dorsiflexion ROM was measured with a goniometer. [Results] Both Gong's Mobilization and MWM were effective at increasing ankle dorsiflexion ROM. However, neither Gong's Mobilization nor MWM can be said to be better than the other at increasing ankle dorsiflexion ROM. [Conclusion] We recommend use of MWM to increase ankle dorsiflexion ROM in closed kinetic chains and use of Gong's Mobilization to increase ankle dorsiflexion ROM in open kinetic chains.

**Key words:** Gong's mobilization, Mobilization with movement, Ankle dorsiflexion ROM

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## INTRODUCTION

The ROM of ankle dorsiflexion is important because restriction brings about functional limitations in daily living. One of the potential causes of decrease in ankle dorsiflexion ROM is restricted posterior glide of the talus on the tibia<sup>1)</sup>. In previous studies examining methods for increasing ankle dorsiflexion ROM, anterior to posterior gliding applied to the talus showed an immediate effect<sup>2, 3)</sup>. Studies have also shown that an immediate increase of the ankle dorsiflexion ROM appears after applying MWM<sup>4)</sup>. In particular, MWM applied to the ankle joint with Kaltenborn's concave rule and motion by the subjects, results in an immediate increase of ankle dorsiflexion ROM, which is facilitated by body weight and gravity<sup>5, 6)</sup>. Although gravity and body weight can be used in MWM as it is applied to the body weight-loaded closed kinetic chain, they are difficult to utilize in subjects who struggle to support their own weight because of arthritis or damaged ligaments, or those who are unable to sit and stand by themselves due to insufficient muscle strength or balance. Anterior to posterior gliding applied to the talus has an advantage in that the body weight is not loaded because it is applied in an open kinetic chain, in which distraction and Kaltenborn's concave rule cannot be applied. In this study, we performed Gong's mobilization in which both distraction and the convex rule were applied to the ankle joint in the prone position by mobilization with passive movement, and compared the effect with that of MWM.

## SUBJECTS AND METHODS

Forty health adult males and females were recruited and randomly allocated to either Gong's group, which was the experimental group (10 males and 10 females), or the MWM group, which was the control group (10 males and 10 females). Those who had problems in the musculoskeletal system or the nervous system, those who had pain in the knees in daily living, and those who might be limited in their ROM because of burns or postoperative scars were excluded. Sufficient explanation about the study purpose and overall procedure of the experiment was given to the subjects, and their voluntary consent to participation was received.

The subjects in Gong's group had a mean age of  $23.0 \pm 4.94$  a mean height of,  $169.9 \pm 8.5$  cm and a mean weight of  $64.6 \pm 11.8$  kg. The subjects in the MWM group had a mean age of  $22.5 \pm 4.3$  a mean height of,  $165.7 \pm 8.4$  cm and a mean weight of  $61.4 \pm 11.3$  kg. The chi-square test was performed for sex, and the independent t-test was performed for age, height and weight. The tests showed that there were no significant differences between the two groups; thus, the two groups were considered homogenous. The ankle dorsiflexion ROM was measured and mobilization was performed for each subject the ankle that showed the least ankle dorsiflexion ROM. The ankle dorsiflexion ROM of each subject was measured using a goniometer (USA) with the subject in a prone position on a bed with 90° knee flexion, and his/her basic axis aligned with the long axis of his/her fibula bone and his/her moving axis aligned with the long axis of his/her 5th metatarsal bone.



**Fig. 1.** Gong's mobilization for ankle



**Fig. 2.** Mobilizations with movement for ankle

Gong's mobilization was performed for Gong's group. The subjects adopted the prone position on the bed, and the posterior inferior region of the thigh on the side of the ankle to be mobilized was fixed under the sole of the therapist. Weak distraction of the talocrural joint was induced by mildly lifting up the ankle with two hands. At that time, the calcaneus was held with one hand, while the instep adjacent to the ankle joint was held and lifted up with the other hand (Fig. 1a). When applying the mobilization, dorsiflexion was caused using the calcaneus while maintaining mild distraction. The trochlea of the talus was pushed to the opposite side using the middle phalanx and proximal interphalangeal joint of the hand lifting up the instep. At that time, a short impact manipulation was applied at the end range of motion (Fig. 1b).

The MWM technique performed for the MWM group was as follows. The subjects were asked to stand on the bed. The level of the bed was adjusted to the level of the hip joint of the therapist. A belt was hung at the posterior inferior region of the tibia of the foot to be mobilized, and the other end of the belt was hung at the hip of the therapist. The belt at the posterior tibia of the subject was held by one hand of the therapist, and the front side of the talus was supported by the web between the thumb and the index finger of the other hand of the therapist (Fig. 2a). During mobilization, at the end range of the subject's motion from the standing position to sitting position, the therapist pulled the posterior side of the tibia to the anterior side with one hand and pushed the talus from the anterior side to the posterior side with the other hand, applying the MWM technique according to the concave rule (Fig. 2b)<sup>7)</sup>.

Gong's mobilization was conducted by Dr. Gong and

was performed 10 times for each individual in the Gong's mobilization group. MWM was performed 10 times for each individual in the MWM group by a therapist with at least 10 year clinical experience.

The experimental results were statistically analyzed using SPSS 12.0 KO (SPSS, Chicago, IL, USA). After the general characteristics of the subjects were determined, the paired t-test was used to compare the changes in ankle dorsiflexion ROM between pre- and post-intervention in each group. The differences between the two groups were tested using the independent t-test. The statistical significance level,  $\alpha$ , was chosen as 0.05.

## RESULTS

The ankle dorsiflexion ROM was compared between before and after the intervention in Gong's group and the MWM group, and both groups showed significant differences ( $p < 0.05$ ) (Table 1). The independent t-test performed with respect to the ankle dorsiflexion ROM values before and after the experiment, as well as the difference between the ankle dorsiflexion ROM values before and after the experiment, showed that there were no significant differences between the two groups ( $p > 0.05$ ) (Table 2).

## DISCUSSION

The ankle dorsiflexion ROM decreases and joint stiffness increases after prolonged immobilization. Landrum et al. performed anterior to posterior talocrural joint mobilization of Grade III for ankles which had been immobilized for at least 14 days, and for which dorsiflexion had decreased by

**Table 1.** Comparison of ankle dorsiflexion ROM between pre- and post-intervention in each group (mean  $\pm$  SD)

Category	(unit: degree)	
	pre intervention	post intervention
Gong's group*	21.3 $\pm$ 4.9	24.6 $\pm$ 3.8
MWM group*	20.5 $\pm$ 8.6	24.8 $\pm$ 7.1

\*  $p < 0.05$ , Gong's group; Gong's mobilization group, MWM group; mobilization with movement group

**Table 2.** Comparison of ankle dorsiflexion ROM between Gong's group and MWM group (mean  $\pm$  SD)

Category	(unit: degree)	
	Gong's group	MWM group
pre intervention	21.3 $\pm$ 4.9	20.5 $\pm$ 8.6
post intervention	24.6 $\pm$ 3.8	24.8 $\pm$ 7.1
difference between pre- and post- intervention	3.3 $\pm$ 4.9	4.3 $\pm$ 4.9

\*  $p < 0.05$

5° or more than that of the ankle of the opposite side. They reported that the ankle dorsiflexion ROM was increased and the ankle joint stiffness was decreased<sup>3</sup>). Green et al. applied anterior to posterior mobilization to painless ankles and reported a result of greater in dorsiflexion ROM.<sup>2</sup>) Collins et al. performed a single application of MWM to subacute ankle sprain patients and reported immediate improvements in dorsiflexion ROM<sup>4</sup>). Reid et al. also applied MWM to chronic ankle sprain patients and reported increased ankle dorsiflexion ROM in the weight-bearing lunge test<sup>5</sup>). In our study, we applied Gong's mobilization and MWM to investigate the immediate effects on ankle dorsiflexion ROM. Our results show that both mobilization methods were effective at increasing the ankle dorsiflexion ROM. However, the results did not show which method was more effective. Gong's mobilization might have been effective because Kaltenborn's convex rule was applied while creating passive movement as well as distraction. MWM might have been effective because Kaltenborn's concave rule was applied while using body weight and gravity. In addition to joint mobilization, studies have been conducted investigating methods for increasing ankle dorsiflexion ROM. Wilson et al. implemented joint mobilizations in combination with therapeutic exercise to the talocrural and subtalar joints for five weeks and reported that ankle dorsiflexion and plantar flexion ROM increased more than when only the therapeutic exercise was performed<sup>8</sup>). Johanson et al. applied stretching for three weeks, two times a week, with a patient who had shortening of the gastrocnemius muscle; they reported increased ankle dorsiflexion ROM<sup>9</sup>). These previous studies show that joint mobilization, therapeutic exercise and stretching are effective at increasing the ankle dorsiflexion ROM. The immediate effects were achieved through joint mobilizations, particularly MWM, which showed an excellent effect. However, one drawback of MWM is that the subjects need to be able to sit and stand by themselves, support their own body weight and maintain their own

balance. Therefore, although neither Gong's mobilization nor MWM can be said to be better than the other at increasing ankle dorsiflexion ROM, we recommend to use of MWM to increase ankle dorsiflexion ROM in close kinetic chains and use of Gong's Mobilization to increase ankle dorsiflexion ROM in open kinetic chains.

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