CHAPTER 5

Discussion and conclusion

5.1 Discussion

Several previous studies have demonstrated that knee orthosis provides beneficial effects to patients with knee OA such as pain reduction, improvement in gait performance and standing balance. However, none of the previous studies have directly compared the two most common types of knee orthosis in individuals with knee OA. This study compared the effects of knee sleeve and OA knee brace on the performance-based tests based on OARSI's recommendation for individuals with knee osteoarthritis (14).

In this study, the KOOS is used as a self-reported questionnaire of functional outcome to describe participants' baseline demographic. This disease-specific questionnaire has been reported with acceptable reliability and validity for Thai patients with knee OA (63). The KOOS has five separate subscales. In each subscale, 100 representing no knee problems and 0 representing extreme knee problems (92). In this study, the average KOOS in Pain, Other symptoms and ADLs subscales were above 50 excepted Sport and recreation and QOL that the KOOS were quite low. Comparing with previous study, KOOS in this study was higher than those previously reported for other Asian with knee OA. Xie et al (93) studied cross-cultural adaptation and validation of Singapore English and Chinese versions of KOOS whose participants were older and having more severe OA symptoms. The results of this study is in accordance with de Groot et al (94) who reported similar KOOS of 62 knee OA patients with moderate severity in Netherland. Therefore, the severity of knee OA is well-reflected in this self-perceived questionnaire. The KOOS questionnaire has been reported to have the clinimetric properties in patients with different severity of knee OA (94).

The results of this study indicated that both types of knee orthosis could improve knee function in knee OA patients which follows the hypotheses of the study. For the performance tests based on time to complete the tests, when wearing either the knee sleeve or the OA knee brace, performance time was decreased for both the 40 meter fast paced walk test and the stair climb test. In addition, an increase in number of chair stand repetitions performed in 30 second is also found in both knee orthosis conditions.

Knee pain causes difficulty in functional performance for patients with knee OA. Reduction in walking speed of knee OA patients is characterized by decreased stride length, increased walking base, and increased time of double support phase which are part of the adaptive mechanism to reduce pain (95). The results of this study found that wearing knee orthosis had some obvious effect on walking performance. This study introduced a challenging gait task, i.e. fast-walking, to the participants, thus changes in gait performance can be clearly observed (96). An increase in walking speed was found with both orthosis conditions. However, the walking speed of participants with knee OA in this study was still lower than reference values for healthy older adults reported earlier. Bohannon (97) reported normative speed for healthy adults; women age 50–59 years, 1.40 ± 0.15 meters/second and men age 50–59 years, 1.39 ± 0.23 meters/second.

It is possible that reduction of knee pain contributed to increased mobility of knee joint. Decreased walking time of the self-paced walk test as a result of increased gait speed was showed in OA patients in both orthosis conditions compared to no-orthosis condition. However, OA knee brace showed superior effect to knee sleeve. Improving in gait parameter has been reported in previous studies investigating the effect of valgus braces for medial knee OA. Bryk et al (11) found that wearing knee sleeve resulted in decreased time of 8-meter walk test and Timed Up and Go test. In this study the spatial-temporal gait was not directly examined. However, the change in walking speed usually occurs as a result of step length and/or cadence modifications. Schmalz et al (98) reported that wearing knee orthosis resulted in improvement of step-length symmetry. Use of a brace decreased the magnitude of gait asymmetry between the braced and contralateral legs, presumably because the pain on knee OA was reduced.

A chair stand movement and stair climbing require greater knee strength, range of motion, and joint moment than walking (99, 100). Normative scores for the 30-second CST in community-dwelling older people aged range 60–64 years were 12–17 stands

for women and 14–19 stands for men (101). The performance time of the stair climb test varies between studies due to different number of stair steps used for testing. Normative scores for the 12-step stair test for moderate knee OA were 11.78 ± 4.70 seconds for men and 19.48 ± 9.30 seconds for women (14). Bouchouras et al (102) found that during a chair stand task women with knee OA had greater knee muscle co-contraction and reduced knee and hip range of motion compared to age-matched controls without knee pain. Muscle co-contraction increases joint stiffness and reduce joint range of motion. Wearing knee orthosis may provide the same mechanism of muscle co-contraction and help protect the knee joint from excessive loading. In this study, the numbers of chair stands are comparable to those reported in previous study. Therefore the participants could perform the chair stand test with increased number of repetitions and walk up and down the 10-step stair way with less time compared to not wearing knee brace has compensated for weakness of the quadriceps femoris muscle and protect knee joint pain.

The superior effect of knee brace and knee sleeve on improvement in functional tests may be described in several aspects. First, proper fit of the knee orthosis can provide additional joint stability and pain reduction. Segal et al (10) and Chuang et al (12) described that knee sleeves and superstructure material of the knee brace are made from cotton elastic or from neoprene or other synthetic fibers that provide warmth and mild compression to the knee joint that may enhance knee joint proprioception. In addition, the compression effect may alter the pain perception according to the gate control theory (103, 104). The compression force stimulates the fast afferent fiber faster than the pain fiber resulting in pain relief. Second, wearing knee orthosis can cause biomechanical alterations to the knee joint. Simple knee sleeves are composing of no rigid structure therefore their direct effect on changing knee joint alignment may not be robust as the knee brace. The knee brace is presented with upright bar that provides additional stability to the knee joint increasing it potential in improving knee function better than the knee sleeve. The effective of knee brace can be described by the three point pressure system especially in the frontal plane. The pulling of orthosis strap can alter the forces acting on knee joint and the pressure distributed away from degenerative area. So the effectiveness of OA knee braces with a three-point bending force mechanism provided its corrective effect to relieve knee pain during functional

activities. Third, the effect of knee orthosis on knee muscles around the knee joint. The problems in OA knee patients such as joint laxity and instability are demonstrated by significant greater co-contraction in medial and lateral side of knee joint during weight acceptance in gait cycle. Increasing co-contractions while stabilizing the knee increases joint compression loading that could exacerbate joint destruction and pain (105). Wearing knee orthosis resulted in unloading of the diseased portion of the joint and thereby helps improve symptoms by stabilizing knee joint, reducing muscles co-contraction and joint compression (106). Callaghan et al (87) found that patients with patellofemoral OA wearing knee brace for 12 weeks did not impair quadriceps muscle strength or increase arthrogenous muscle inhibition. On the other hand, individuals with knee orthosis had improvement in the neural control of quadriceps muscle and decrease in muscle atrophy.

The results of this study are in agreement with other investigators who also reported the benefits of off-the-shelf brace on pain relieve and knee function improvement (106, 107) and similar to other reports using the customized brace (13, 108). However, previous study reported the problem of adherence for a long term use. Most patients tended to have a low coherence (less 4 hour daily use) and poor compliance rates due to the lack of noticeable benefits, poor fit and aesthetic aspects of the braces (bulkiness, weight, size) (109). Although the OA knee brace and knee sleeve were both effective in the treatment of patients in this study, the decision whether which type to choose for knee OA patients should be advised. In this study, it was found that level of knee pain was related to the participants' selection of knee orthosis. The results from this study suggested that the participants chose their knee orthosis of choice in relation to their knee pain in the previous month. Significant proportion of participants with less knee pain chose the knee sleeve whereas those with more substantial knee pain were more satisfied with the OA knee brace over the knee sleeve. Therefore, the suggestion of the proper type of knee orthosis may take patient satisfaction into account. The knowledge gained from this study may provide additional information for clinicians to prescribe or recommend proper type of knee orthosis for knee OA patients.

5.2 Limitations and future study

There were three limitations of this study. First, in this study, NRS for pain was not assessed before testing each condition that might affect the test scores. However, the knee OA condition was chronic that the tests representing the daily activities could not make the condition become worse. In addition, sufficient rest time between conditions was provided. Second, the results of this study are based on those who were diagnosis with mild to moderate severity of knee OA. The results may not be generalized to other those with other severity because the effect of bracing on functional performance may be different. Third, this study examined only the immediate effect of knee orthosis. In addition, the long term effect and more objective gait parameters such as step distance or time variables of gait cycle need to be explored further in order to clearly describe the effect of knee orthosis on functional performance in OA knee patients.

5.3 Conclusion

The use of knee sleeve and OA knee orthosis was shown to have immediate benefits for participants with mild medial knee osteoarthritis as indicated by significant improvement in all functional outcomes including increased number of chair stand repetition and decreased times in walking and stair climbing tests. In addition, the efficacy of both knee sleeve and OA knee brace aided in the reduction of knee pain during the functional performance (chair stand and stair climbing). The effect of knee sleeve or knee brace was not different in the level of pain during walking test. However, wearing the OA knee brace revealed superior benefits to the knee sleeve condition and the OA knee brace was more satisfied by those who experienced higher level of knee pain.