

Effectiveness of Kinesio Taping in the Management of Knee Osteoarthritis

ABSTRACT

Background: Knee osteoarthritis (OA) is one of the commonest chronic joint problems presenting with pain and stiffness. As a consequence, activities of daily living are limited and decline the quality of life. Kinesio tape (KT) has been popular in worldwide by its positive effects including reducing pain, relieving stiffness and improving function. However, the therapeutic application tension, direction and technique have not been identified yet and still weak evidence in OA knee.

Aims: To find out the effectiveness of Kinesio taping in the management of OA knee.

Study Design: Hospital based randomized control trial.

Place and Duration of Study: This study was conducted in the Outpatient Department of Physical Medicine and Rehabilitation in both Mandalay Orthopedics Hospital and 300 Bedded Teaching Hospital, Mandalay. It was started from May, 2017 to August, 2018.

Methodology: A total of 60 patients were randomly assigned into group A and group B. Group A (intervention group) received KT plus conventional exercise and group B (control group) received conventional exercise alone. Both groups were assessed in week 0 (before study), week 2 (during study) and week 3 (end of study). Assessments measures were VAS, WOMAC index and TUG test. The amount of analgesic consumptions was recorded in week 2 and week 3 assessments.

Results: There were no significant differences in baseline characteristics of patients between the two groups. The intragroup analysis showed significant difference in VAS, WOMAC index and TUG test ($p < 0.05$) in both groups. However, intergroup analysis showed more significant improvements of VAS, WOMAC index and TUG test in intervention group than control group in week 2 and week 3 ($p < 0.05$).

Conclusion: KT plus conventional exercise is more effective than conventional exercise alone in terms of relieving pain, reducing stiffness and improving function in patients with OA knee.

Keywords: Knee osteoarthritis; Kinesio tape; Kinesio taping.

1. INTRODUCTION

Osteoarthritis (OA) is a degenerative disease of joint that implicates the cartilage and its nearby structures. Pain, stiffness, swelling, joint instability and muscular weakness are common characteristics of the OA. The resultant is not only diminished daily activities but also impaired quality of life of individual for the reason that pain limits movements such as walking, squatting, ascending and descending stairs [1]. Knee joint suffers osteoarthritis more than any other joint due to its functions of weight bearing and repeated movements [2].

About 250 million people (3.6% of population) suffered OA knee worldwide in 2010 and it is suspected that it can be the fourth cause of disability in 2020 [3]. Treatment for the course of condition of OA has not available yet. Therefore, treatment approaches are focused on relieving symptoms of disease [4]. Current OA knee treatment strategies include pharmacologic, non-pharmacologic and surgical managements [2]. Physiotherapy treatment is one of the non-pharmacologic treatments. Current physiotherapy treatments for OA knee include physical modalities, manual therapy, exercises, hydrotherapy and taping [5]. Modalities have been used as adjunct treatment to reduce pain in short term [6].

Kinesio tape (KT) is cotton elastic therapeutic tape created by Kenzo Kase in 1979. It has waterproof, breathable, and hypo allergic properties and can be worn up to three to five days. KT has been shown many benefits such as reducing pain, supporting the functions of ligaments and tendon, correcting malposition of structures, increasing range of motion and promoting healing process. KT has benefit over rigid tape in providing stability and protection together with full range of joint motion [7].

35 Furthermore, pain relief effect of KT may reduce the analgesic consumption in OA knee patients.
36 Therefore, KT is more suitable for patients such as patients who have gastric ulcer, hypertension,
37 bleeding disorders and patients who are contraindicated to analgesic. As it does not restrict joint
38 movement, it can be used along with exercises and patients can go to work without interference.
39

40 However, physiologic mechanism of KT is still unclear. The standardized application technique and
41 tension have not been identified yet. The systemic review and meta-analysis of KT on OA knee
42 concluded that there is insufficient evidence of KT in treating OA knee and more studies are still
43 needed [8]. Therefore, the aim of this study is to determine the effectiveness of KT in OA knee
44 management.
45

46 **2. METHODOLOGY**

47 **2.1 Study Area**

48 This study was conducted in the Outpatient Department of Physical Medicine and Rehabilitation in
49 both Mandalay Orthopedics Hospital and 300 Bedded Teaching Hospital, Mandalay.
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53 **2.2 Study Population**

54 All patients with OA knee attending Physical Medicine and Rehabilitation Department, Mandalay
55 Orthopedics Hospital and 300 Bedded Teaching Hospital, Mandalay.
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58 **2.3 Study Design**

59 This was a hospital based randomized control trial.
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62 **2.4 Selection Criteria**

63 Diagnosis of OA knee by physiatrists and patients who are age above 50 are included in this study.
64 Exclusion criteria were allergic reaction to tape, history of knee joint surgery and inflammatory
65 arthritis.
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67

68 **2.5 Data Collection Method and Tools**

69 This study was conducted in the Outpatient Department of Physical Medicine and Rehabilitation in
70 both Mandalay Orthopedics Hospital and 300 Bedded Teaching Hospital, Mandalay. It was started
71 from May, 2017 to August, 2018.
72
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74 60 patients who met the inclusion criteria were included. These patients were randomly allocated into
75 two groups either group A (KT plus conventional exercise group) or group B (conventional exercise
76 alone group) according to randomization procedure using block randomization program available at;
77 [https:// www.sealedenvelope.com/simple-randomiser/v1/lists](https://www.sealedenvelope.com/simple-randomiser/v1/lists). Written informed consent was obtained
78 from the patient after thorough explanation about aims and objective of the study.
79

80 **The Intervention Programs**

81 The Group A (Intervention group) received Kinesio tape application to knee with 2 times per week for
82 3 weeks and conventional exercise for 3 weeks. Group B (Control group) received conventional
83 exercise only. Both groups were allowed to take analgesic prescribed by physiatrists if they were not
84 bearable to pain.
85

86 Before application of KT, the area to be treated was cleaned and checked. All the patients who were
87 eligible to this study were taken allergic test to KT. In this taping method, it consists of 3 strips (Two
88 "Y" strips and one "I" strip). The anchor portion of the tape is about 4cm in length. The length of "Y"
89 strip is about 13 cm and "I" strip is about 11 cm. All bases of stripes and ends of stripes were applied
90 with paper off tension. The desire tension is applied between the bases and ends (Middle portion).
91 The patient was positioned in supine lying with maximum knee flexion. The first "Y" strip represent of
92 quadriceps and the tails wrap the patella medially and laterally with 50% tension. For the second strip

93 "Y" strip was applied between tibial tuberosity and inferior pole of the patella with 90° of knee flexion.
94 The tails wrap the patella medially and laterally with 50% tension. For the third "I" strip was applied to
95 patella mediolateral with 50% tension in the position of 30° knee flexion (Figure 1). The KT application
96 was kept for 3 days. After three day interval, KT was replaced. The patient was renewed KT in cases
97 the tape had separated.
98

99 Conventional exercise included bilateral toes touching exercise, full range knee extension exercise
100 and mini squat exercise at every movement with 10 times per session. These exercises were given
101 three sessions daily for 3 weeks.
102

103 Patients not attending treatment consecutively for 2 sessions were taken as drop-out. There was no
104 dropped-out in this study.



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106

107 Figure 1 Kinesio tape application (a) The first "Y" strip application with maximum knee flexion (Left)
108 (b) The second "Y" strip application with 90° knee flexion (Left) (c) "I" strip application with knee
109 30°flexion (Left)

110 **Assessment**

111 Assessments were done at week 0 (baseline), week 2 (during the study period) and week 3 (end of
112 study).
113

114 **Visual Analogue Scale (VAS)**

115 VAS measures the pain intensity. It is self-administered and it consists of 100mm (10cm) line. The
116 scale is commonly anchored by "no pain" (score of 0) and "worst imaginable pain" (score of 100). The
117 respondent is asked to place a mark on VAS line at the point that represents the pain intensity. A
118 higher score indicates greater pain intensity [9].
119

120 **The Western Ontario MacMaster Osteoarthritis Index (WOMAC)**

121 WOMAC index consists of pain, stiffness and functions subscales with 5, 2 and 17 items respectively.
 122 The individual may require just about 5 minutes to response these items that comprise in WOMAC
 123 scale. In this study, Likert version was used. Likert version is simple to use and offers five responses:
 124 "none" is score as "0", "mild" as "1", "moderate" as "2", "severe" as "3" and "extreme" as "4". The
 125 more increase in score, the worse the condition [10].

126

127 **The Timed Up and Go test (TUG test)**

128 TUG test is used to perform to access the speed during performing functional tasks that disrupt
 129 balance. This test requires the patient to rise up from chair, stand and walk to a line on the floor 3
 130 meters, turn around, walk back to chair and sit down. The outcome measure of this test is the total
 131 time taken by the patient to complete the entire task. Timing begins when the word "go" and stops
 132 when the patient's bottom touches the chair by using hand held stopwatch. A practice trial is carried
 133 out prior to the testing. Three test measurements will be taken and the average timing will be counted
 134 for that particular assessment [11]. This test can take average of minimum 10 seconds and maximum
 135 3 minutes [12].

136

137 **2.6 Data Processing and Analysis**

138

139 Data analysis was done by using STATA software version 13.0. For comparison of demographic data
 140 between the groups, two sample t-test and chi-square test were used. For comparison of mean
 141 variables within the same group before and after treatment, paired t-test was used. For comparison of
 142 mean difference variables between week 0-2, week 0-3 of the two groups, two-sample t-test was
 143 used. The results were considered statistically significant if p value was less than .05.

144

145 **2.7 Ethical Consideration**

146

147 Ethical approval for this study was obtained from the Ethical Review Committee from University of
 148 Medical Technology, Mandalay, Myanmar. Implementation Research Grant by Ministry of Health and
 149 Sport, Myanmar provided financial support for conducting this research. Written informed consent was
 150 obtained from the patient after thorough explanation about the study. It was carried out in an area
 151 where adequate facilities to manage the complications are readily accessible and not life threatening.
 152 Kinesio tape is widely used for a variety of musculoskeletal conditions. It has fewer risk and
 153 complication. It was performed by well experienced physiotherapist. The recognized risk can be
 154 minimized by adhering to the precautions of KT. There was neither charge nor incentive for
 155 participants. Patients who participate in this study were volunteers and had the right to withdraw from
 156 the study at any time and changed appropriate treatment regime. The result of this study was used for
 157 research purposes only and was kept confidential.

158

159 **3. RESULTS**

160

161 Table 1 revealed demographic data of the two groups. Mean age was 63.57±9.71 in intervention
 162 group and 61.23 ± 8.44 in control group. There was no statistically difference in age between the two
 163 groups (p=.32). With respect to male and female proportion, there were 3 males and 27 females in
 164 intervention group and there were 1 male and 29 female in control group according to randomization
 165 procedure. No significant difference in sex distribution between two groups was observed (p=.30).

166

167

Table 1. Demographic characteristic of the 2 groups at baseline

168

Characteristics	Variables	Intervention group (n=30)	Control group (n=30)	p value
Age (mean ± SD)		63.57 ± 9.71	61.23 ± 8.44	.32 (t test)
Sex	Male	3 (10.00)	1 (3.33)	.30 (X ²)
	Female	27 (90.00)	29 (96.67)	

169

170 Table 2 showed baseline data of intervention and control group. The outcome measures VAS,
 171 WOMAC pain, WOMAC stiffness, WOMAC function, WOMAC total score and TUG test were not
 172 different significantly at baseline (week 0) assessment.

173
 174 **Table 2. Assessment measure of the 2 groups at baseline**
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Variables	Intervention group (n=30)	Control group (n=30)	t test (p value)
	Mean ± SD	Mean ± SD	
VAS pain score (mm)	67.47 ± 20.73	69.17 ± 26.34	.78
WOMAC pain score	13.13 ± 4.57	14 ± 5.25	.50
WOMAC stiffness score	4.87 ± 2.1	4.97 ± 2.27	.86
WOMAC function score	46 ± 14.75	45.07 ± 17.32	.82
WOMAC total score	64 ± 20.68	64.03 ± 24.05	.99
TUG test (seconds)	18.57 ± 4.78	19.23 ± 4.71	18.57

176
 177 Table 3 indicated comparison of mean changes in week 0 vs 2 and week 0 vs 3 in intervention group.
 178 The Intra group analysis of intervention group found that all outcome measures were significantly
 179 difference in both week 0 vs 2 and week 0 vs 3 (p<.05).
 180

181 **Table 3. Intra group analysis of Intervention Group**
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Variables	Mean (mm) ± SD			Mean changes (mm) ± SD	
	Week 0	Week 2	Week 3	Week 0 vs 2	Week 0 vs 3
VAS pain score (mm)	67.47±20.73	33.97±17.17	17.3±13.44	33.5±12.55	50.17±16.28
	t test (p value)			<.0001	<.0001
WOMAC pain score	13.13±4.57	6.7±3.04	3.9±2.45	6.43±3.63	9.23±4.53
	t test (p value)			<.0001	<.0001
WOMAC stiffness score	4.87±2.1	2.77±1.7	1.77±1.36	2.1±1.81	3.1±1.65
	t test (p value)			<.0001	<.0001
WOMAC function score	46±14.75	22.67±8.7	11.97±7.03	23.33±11.03	34.03±14.68
	t test (p value)			<.0001	<.0001
WOMAC total score	64±20.68	32.13±12.46	17.63±10.14	31.87±15.4	46.37±19.98
	t test (p value)			<.0001	<.0001
TUG test (seconds)	18.57±4.78	16.63±4.35	15.23±4.03	1.93±1.34	3.33±1.95
	t test (p value)			<.0001	<.0001

183
 184 Table 4 discovered the difference in week 0 vs 2 and week 0 vs 3 in control group. All outcomes
 185 measures were different significantly in week 0 vs 2 and week 0 vs 3 in intra group analysis of control
 186 group (p<.05).
 187

188 **Table 4. Intergroup analysis of Control Group**
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Variables	Mean (mm) ± SD			Mean changes (mm) ± SD	
	Week 0	Week 2	Week 3	Week 0 vs 2	Week 0 vs 3
VAS pain score (mm)	69.17±26.34	54.8±20.63	40.37±16.54	14.37±9.5	28.8±16.94
	t test (p value)			<.0001	<.0001

WOMAC pain score	14±5.25	11.2±4.78	7.17±3.9	2.8±2.62	6.83±4.42
	t test (p value)			<.0001	<.0001
WOMAC stiffness score	4.97±2.27	4.07±2.15	2.9±1.69	0.9±1.09	2.07±1.68
	t test (p value)			.0001	<.0001
WOMAC function score	45.07±17.32	36.97±13.45	26±12.97	8.1±6.12	19.06±12.55
	t test (p value)			<.0001	<.0001
WOMAC total score	64.03±24.05	52.23±19.36	36.07±17.47	11.8±8.58	27.97±17.73
	t test (p value)			<.0001	<.0001
TUG test (seconds)	19.23±4.71	18.13±4.41	17.13±4.49	1.1±0.92	2.1±1.09
	t test (p value)			<.0001	<.0001

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The intergroup analysis between intervention and control group was shown in table 5. The intervention group was more significantly improved than control group in all outcomes measures (p<.05).

Table 5. Comparison of effectiveness between two groups

Variables	Week	Intervention group		Control group		p value (t test)
		Mean Changes (mm)	SD	Mean Changes (mm)	SD	
VAS pain score (mm)	Week 0 vs 2	33.5	12.55	14.37	9.5	<.0001
	Week 0 vs 3	50.17	16.28	28.8	16.94	<.0001
WOMAC pain score	Week 0 vs 2	6.43	3.63	2.8	2.62	<.0001
	Week 0 vs 3	9.23	4.53	6.83	4.42	.04
WOMAC stiffness scores	Week 0 vs 2	2.1	1.81	0.9	1.09	.003
	Week 0 vs 3	3.1	1.65	2.07	1.68	.019
WOMAC function score	Week 0 vs 2	23.33	11.03	8.1	6.12	<.0001
	Week 0 vs 3	34.03	14.68	19.07	12.55	.0001
WOMAC total score	Week 0 vs 2	31.87	15.40	11.8	8.58	<.0001
	Week 0 vs 3	46.37	19.98	27.97	17.73	.0004
TUG test (seconds)	Week 0 vs 2	1.93	1.34	1.1	0.92	.0068
	Week 0 vs 3	3.33	1.95	2.1	1.09	.0038

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Table 6 showed comparison of frequency of analgesics consumption between the two groups. the analgesics usage was significantly lessen in intervention group than control group (p<.05).

Table 6. Comparison of analgesic consumption between two groups at week 2 and week 3

Variables	Week	Intervention group		Control group		p value (t test)
		Mean (mm)	SD (mm)	Mean (mm)	SD (mm)	
Analgesics frequency	Week 2	1.33	4.38	17.17	7.84	<.0001

	Week 3	0.43	1.55	5.43	4.58	< .0001
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204 **4. DISCUSSION**

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206 OA knee is one of the most common musculoskeletal conditions and degenerative joint disorder. The
 207 prevalence of OA knee is high in elderly population, particularly elderly females in Asia. Persons with
 208 OA is limited their physical activities due to this disease and their quality of life is also declined [13].
 209 Disease modifying agents for OA is not available, treatment strategies are directed to relieve
 210 symptoms that are correlated to this disease [4].

211

212 The present research studied the effectiveness of KT plus conventional exercise versus conventional
 213 exercise alone in the management of OA knee. This study was conducted from May 2017 to August
 214 2018. A total of 60 patients were randomly assigned into group A and group B. Group A (intervention
 215 group) received KT plus conventional exercise and group B (control group) received conventional
 216 exercise alone. Therefore, there were 30 patients in both groups who completed the study and a total
 217 of 60 patients were included in data analysis. There were three patients who reported the mild
 218 adverse effect of KT (mild itchy) but received complete intervention without requiring medical
 219 treatment. The effectiveness of intervention was measured with VAS for pain, modified WOMAC index
 220 for pain, stiffness and function and TUG test for ambulatory function. Assessments were done at week
 221 0 (baseline), week 2 (during the study period) and week 3 (end of study). Moreover, analgesic that
 222 was given by physiatrists was recorded and all the patients were instructed not to taken analgesic if
 223 they were bearable to pain. The frequency of analgesic taken by patients was checked in follow up
 224 assessments: week 2 and week 3.

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226 The baseline demographics and baseline assessment measures were not significantly different
 227 between the two study groups. There was significant improvement in pain by measuring VAS and
 228 modified WOMAC pain score, stiffness by measuring modified WOMAC stiffness score, function by
 229 measuring modified WOMAC function score and ambulatory function by TUG test in both groups after
 230 intervention. Intergroup analysis showed more statistically significant improvement in all outcome
 231 parameters in intervention group than control group. In addition, the frequency of analgesic
 232 consumption was significantly lower in intervention group than control group.

233

234 The more reduction of pain was noticed since after 15 days of treatment with KT and exercise in
 235 management of OA knee in comparison with exercise group [14]. Tripathi & Hande (2017) found that
 236 KT plus conventional exercise group studied in geriatric population showed more significant
 237 improvement of pain than conventional exercise group after 3 weeks intervention [15]. The present
 238 study showed more significant reduction of pain was found in intervention group than control group.
 239 Therefore, the result of this study was compatible with literatures.

240

241 Immediate improvement in stiffness of OA knee in KT group compared to sham taping group was
 242 reported [16]. Castrogiovanni and colleagues (2016) also reported that stiffness reduction of OA knee
 243 patients in KT plus exercise group than exercise group [14]. Therefore, the above results agree with
 244 the present study. By contrast, there was no stiffness reduction in OA knee in KT group in comparison
 245 with control group in some study [17]. This may be due to different in taping techniques. They used
 246 facilitation technique of muscle whereas the present study used stabilizing effect of kinesiio taping
 247 technique.

248

249 Ogut and colleagues (2018) compared KT treatment and sham KT in sixty one OA knee female
 250 patients and determined a significant improvement in function in KT group after 3 weeks treatment
 251 [18]. This finding was consistent with the current study. On the other hand, no improvement in function
 252 was found in KT group with compared to sham in above 60 years old OA knee patients [19]. This may
 253 be due to different in KT application. The current study used stabilizing application technique of KT to
 254 knee with fascia, space and mechanical correction application while Wageck and colleagues (2016)
 255 used inhibitory effect of KT to quadriceps and shorter duration of treatment period than the present
 256 study [19].

257

258 The result of improvement in WOMAC total score of this study was consistent with Aiyegbusi,
 259 Ogunfowodu & Akinbo (2018), Lee, Yi & Lee (2016) and Tripathi & Hande (2017) who studied effects

260 of KT in OA knee where WOMAC total score were more improved in intervention groups than control
261 groups in OA knee patients [16, 18, 20, 15]. By contrast, there was no improvement in WOMAC total
262 score after application of KT in OA knee patients [21]. This may be due to inclusion criteria such as
263 small sample size (only 38 patients), Kellgren and Lawrence grade 3 & 4 and Kinesio taping
264 technique is only quadriceps muscle facilitation technique and not comprises knee stabilizing effect in
265 Sarallahi and colleagues (2016) study [21].
266

267 In the study of Castrogiovanni and colleagues (2016), there was improvement in ambulatory function
268 in KT plus exercise group than exercise alone group. Therefore, Castrogiovanni and colleagues
269 (2016) study agree with the present study [14].
270

271 With respect to frequency of analgesic consumption, patients were given analgesic as required by
272 physiatrists for ethical reason. Different generic names and different frequencies of analgesic were
273 included in this study. The consumption was checked at week 2 and week 3 assessments. On
274 analyzing the frequency of analgesic consumption, intervention group was significantly lower than
275 control group. This means that KT has analgesic effect. It is in agreement with Castrogiovanni and
276 colleagues (2016) in which amount of analgesic consumption was lower in KT plus exercise group
277 than exercise only group in OA knee patients [14]. Similarly, Homayouni, Foruzi & Kalhori (2016)
278 investigated the analgesic effect of KT on pes anserinus tendino bursitis in which KT alone was more
279 effective than naproxen plus conventional physiotherapy treatment [22].
280

281 OA knee is the most common degenerative disease of joint presenting pain, decrease muscle
282 strength, decrease stability and stiffness. KT is constructed to aid and increase natural healing
283 process of the body and it has numerous type of application and advantage of use. It is suggested
284 that it has an effect of localized improvement of blood and lymph flow, decreasing pain, providing
285 anatomical support, enhancing muscle activity and range of motion of joint, and assisting
286 proprioception [15]. However, the standardized skills of application and elastic tension have not been
287 identified yet [8].
288

289 The present study found that both groups showed improved significantly in pain, stiffness and function
290 but the intervention group showed a more significant improvement than the control group. Therefore,
291 it can be stated that the additional effect in the intervention group was may be due to KT. This
292 improvement may be related to pain relief effect of KT and regulation of muscle tone by KT.
293

294 Possible mechanism for pain relief by KT is as follow. Stabilizing effect (structural support) of KT is
295 believed to relief pain. In addition, lifting effect of KT create additional space between the dermis and
296 the muscle. This additional space is supposed to relieve pressure on the pain receptors located under
297 the skin resulting pain relief. Moreover, Pacini's bodies which correspond in rapid pressure changes
298 and vibration and Rufini's receptors which correspond in prolonged pressure are activated. The
299 resultant is suppressed sympathetic activities. Also, relieves the pain by activating descending pain
300 suppression system [23, 24, 15].
301

302 The application of KT with tension activates mechano-receptors that causing impulses reaching brain.
303 Consequently, muscle tone abnormality that is said to be triggering of cartilage degeneration is
304 regulated. Resultant is reducing pain, reducing stiffness and improving function of OA knee so as to
305 reducing of abnormality of increase muscle tone [23, 20].
306

307 Conventional exercises including stretching, mobilization and strengthening exercises were given in
308 both groups. This can contribute to improvements found in both groups. However, intervention group
309 showed statistically better improvement than control group in intergroup analysis by means of VAS,
310 WOMAC score, TUG score and reduction in frequency of analgesic consumption. Therefore it can be
311 concluded that KT plus conventional exercise is more effective than conventional exercise alone in
312 terms of relieving pain, reducing stiffness and improving function in the treatment of OA knee.
313

314 **5. CONCLUSION**

315
316 KT plus conventional exercise is better than conventional exercise alone in terms of VAS, WOMAC
317 score, TUG test and lower frequency of analgesic consumption. Hence significant relief in pain,

318 reduction of stiffness, improvement in function and reduction in analgesics consumption can be
319 attained with KT in patients with knee OA. Therefore, KT should be incorporated in the non-
320 pharmacological management of OA knee.
321

322 There are some limitations in this study. Firstly, study is relatively short treatment period and no long-
323 term follow-up. Thus carryover effect of KT cannot be found out in this study. Another limitation is that
324 all compartments of the knee OA are included in this study. Therefore, further study of KT for specific
325 compartment of OA knee with longer duration and follow-up period should be carried out.
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327

328 **CONSENT**

329

330 Written informed consent was obtained after full explanation of the study purpose to them and their
331 rights as participants were provided by the researcher.
332

333 **ETHICAL APPROVAL**

334

335 Approval of this study was obtained from Research and Ethics Committee of the University of Medical
336 Technology, Mandalay.
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338 **COMPETING INTERESTS**

339

340 Authors have declared that no competing interests exist.
341

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