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Original Article

The Impact of Different Number of Flipped Classroom Experiences on Students' Workload

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Abstract. [Purpose] The purpose of this survey was to determine the relationship between the experiences of flipped classes and students' workload. [Subjects and Methods] The participants were 162 undergraduate students in the Department of Physical Therapy. The students took one flipped class-style lecture each in the first and second semesters of the academic year. After all the lectures were completed, questionnaires were administered to students about the workload of the flipped classes and the ease of understanding and learning in the lectures. [Results] The results showed that as the experience of flipped classes increased, the workload of flipped classes decreased, and students reported that flipped classes were easier to understand and learn than the traditional lecture style. [Conclusion] An increase in the number of experiences with flipped classes suggested that students feel less workload for flipped classes and more effective in learning the flipped classroom style.

Keywords：Flipped classroom, Course workload, Course experience

(This article was submitted August.3, 2020, and was accepted August.11, 2020)

1. INTRODUCTION

Flipped classroom, which has attracted attention as an epoch-making new educational method, have been adopted in institution of higher education, and are no exception in the field of medical education. Flipped classroom was first held by Bergmann and Sams in 2007, and the major difference from the Traditional course is that students participate in the actual class after watching the class video online, and in the actual class, the teacher becomes the facilitator and actively studies in group discussions, etc.[1,2)]. As for the educational effect of flipped classroom, there are reports that students can acquire more applied knowledge than conventional classes and that test scores increase [3-5)]. However, as a condition for introducing the flipped classroom, it has been reported that since students need to watch the course video in advance, the amount of time they spend studying outside the course increases, increasing the workload on students[6)]. In our previous study, we evaluated the workload felt by students when they introduced flipped classroom on a ten-point scale. The median score was 3, but some students answered that the workload was large. When comparing the ease of understanding and learning with traditional courses, about 70% of students responded that they had flipped courses, while about 20% preferred traditional courses[7)]. Missildine et al.[8)] pointed out that the process by which students acquire knowledge is different from the conventional teaching method, and careful follow-up is necessary when they accumulate learning. In addition, many researchers such as Lo and Hew[9)] have also stated that a careful orientation at the time of the introduction of flipped classes is the key to success, and the importance of prior explanations to students has become

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clear. Imafuku[10] conducted a survey on students' responses to the introduction of a new class format in lectures for university students, and reported that students can improve their learning efficiency by adapting to the new class format.

Therefore, since students need to adapt to learning methods that are different from conventional classes, the more experience they have with flipped classes, the more students who prefer flipped classes, and the less workload they feel with learning compared to conventional classes. The purpose of this study was to clarify the changes in students' workload and preference for course methods depending on the number of experiences of flipped classroom.

2. SUBJECTS AND METHODS

The subjects were 162 physical therapy students (male: 87, female: 75; age: 20.1± 1.2 years) who took reversed courses in 2018 and 2019. The students took one course each in the first and second semester of the flipped styled class. All students had never taken a flipped classroom before.

A questionnaire survey of students was conducted at the end of each semester after all lectures were completed. The questionnaire investigated the students' perception of the workload in an FC compared to what they perceived in a TC using a ten-point scale (from 1: not at all to 10: very much). In addition, "ease of understanding" and "ease of learning," was investigated using a five-point Likert scale: 1: traditional; 2: likely traditional; 3: neither; 4: likely flipped: and 5: flipped.

The survey was compiled every semester. The results of the questionnaire for the first semester subjects were taken as the results of the first flipped class, and those for the second semester subjects were taken as the results of the second flipped class. The median and quartile range of student workload were calculated, and the number of students who responded in each of the ten-point scale was totaled. The results of the questionnaire on "ease of understanding" and "ease of learning" were cross-tabulated on a five-point Likert scale and the number of times the students had experienced flipped classes. The Wilcoxon Signed test was used to examine differences in students' workload during each semester. In addition, the number of answers for each workload, "ease of understanding" and "ease of learning" were compared between semesters using chi-square test and residual analysis. The statistical significance was judged at the level of $p < 0.05$ for over ± 1.96 and $p < 0.01$ for over ± 2.58 by the residual error. Statistical analyses were performed using IBM SPSS Statistics, version 24 (IBM Japan Ltd., Tokyo, Japan).

The study was approved by the International University of Health and Welfare Ethics Committee (Approval number: 16-IO-143). In accordance with the Declaration of Helsinki, participants were provided an information sheet on the study, and they gave written informed consent.

3. RESULTS

The response rate to the questionnaire was 100% (162 people) after the first flipped course and 92.0% (149 people) after the second flipped course. Table 1 shows the number of responses and the percentage of the students' workload for each point according to the number of experiences in flipped classroom. The distribution of the students' workload changed with the increase of the experience of the flipped class. There was a significant increase in the number of respondents who answered that the workload was 1 or 2 ($p < 0.01$). The number of students who answered 8 to the workload decreased significantly after the second experience ($p < 0.01$). In Table 2 and Table 3, the results of the questionnaire on "ease of understanding" and "ease of learning" of the class were compared by the experience number of the flipped classroom. The number of "Flipped" increased significantly as the number of experiences increased, and the number of "Traditional" decreased significantly.

Table 1. Comparison of 1st and 2nd time of workload

Workload	1st time (%)	2nd time (%)	Residual error	*p* value
1	27 (16.7)	41 (27.2)	2.35	.024
2	16 (9.9)	28 (18.5)	2.20	.027
3	44 (27.2)	27 (17.9)	-1.96	.050
4	20 (12.3)	17 (11.3)	-0.30	.766
5	17 (10.5)	12 (7.9)	-0.78	.437
6	14 (8.6)	10 (6.6)	-0.67	.502
7	6 (3.7)	3 (2.0)	-0.91	.364
8	12 (7.4)	2 (1.3)	-2.60	.009
9	2 (1.2)	6 (4.0)	1.53	.125
10	4 (2.5)	5 (3.3)	0.45	.656
Total	162	149		
Median	3	3		.014
25-75 percentile	2-5	1-5		

$\chi 2$ test 21.9 (*df*: 9)

Table 2. Ease of understanding

	1st time (%)	2nd time (%)	Residual error	*p* value
Flipped	52 (33.3)	81 (54.4)	3.70	.024
Likely Flipped	47 (29.0)	39 (26.2)	-0.60	.027
Neither	36 (22.2)	21 (14.1)	-1.90	.050
Likely Traditional	11 (6.8)	7 (4.7)	-0.80	.766
Traditional	14 (4.5)	1 (0.3)	-3.30	.437
Total	162	149		

$\chi 2$ test 22.3 (*df*: 4)

Table 3. Ease of learning

	1st time (%)	2nd time (%)	Residual error	*p* value
Flipped	56 (34.8)	77 (51.7)	3.00	.024
Likely Flipped	57 (35.4)	52 (34.9)	-0.10	.027
Neither	28 (17.4)	11 (7.4)	-2.70	.050
Likely Traditional	4 (2.5)	6 (4.0)	0.80	.766
Traditional	16 (9.9)	3 (2.0)	-2.90	.437
Total	162	149		

$\chi 2$ test 21.7 (*df*: 4)

4. DISCUSSION

Many studies have examined the educational effects of flipped classroom. The main advantage of flipped classroom is believed to be that active learning, such as group work, enhances applied knowledge and capabilities. Previous studies have shown that many students prefer a reverse-course style and continue to want to take classes[11,12]. Our study also reported that about 70% of students preferred inverted teaching[7]. However, it has been pointed out as a problem that the workload on students increases by forcing them to study in advance[6]. In our study, we quantitatively evaluated the students' workload and found that the workload varied and that about 10% of students preferred the traditional teaching style[7]. We need to be careful not to leave these students behind as we introduce new teaching methods. In this study, we investigated changes in students' attitudes through multiple experiences in the flipped class as well.

Thus, we conducted a questionnaire survey on the students' evaluation due to differences in the workload and lecture style of students who participated in flipped classroom, and investigated the effects of differences in the number of experiences in flipped classroom. Although there was no change in the median value of the students' workload, we found that the distribution of the workload tended to decrease after the 2nd experiences. These results indicate that the students' workload reduced by experiencing more flipped style classes. Cotta et al.[11] reported that students were positive about flipped classroom and that more students would prefer it if they got used to the learning style. We consider that the results of this study quantitatively support their claim.

In addition, the number of flipped classroom experiences was found to change the format of the classes that made it easier for students to learn. The results in Tables 2 and 3 show that as the number of experiences of flipped classes increased, more students reported that flipped classes were better than traditional lectures in terms of ease of understanding and learning of course content. There were about 10% of students who preferred traditional classes after the first flipped class, but there was a significant decrease after the second flipped class and a significant increase in the number of students who answered "Flipped". For this reason, it is possible that students, who were initially negative about the flipped format, realized the benefits of its course and were able to adapt to a wider learning style. As a limitation of this study, it was not possible to adjust the academic ability of the students in different academic years by considering the students in different academic years in order to target many students. However, since the subjects of the flipped course and their teaching contents are the same, we may consider that the results were not be

affected by the differences in the subjects. In addition, although "workload" can be interpreted in many ways, such as physically, mentally, and temporally, this survey failed to clarify its definition.

In this study, we investigated the effect of the number of experiences of the flipped classroom on students' workload. New teaching methods are being developed one after another, but in order to support students' continuous learning, it is important to understand their workload of learning and respond appropriately. The results of this study suggest that students feel less burdened and adapt to new ways of learning. In the future, the study efficiency and workload of the students in the home study such as the online class will be investigated.

Funding and Conflict of interest

No funding was provided for this study. The author declares no conflict of interest.

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The author is grateful to the subjects and co-author for assistance with data acquisition.

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Original Article

Effects of the Long-Term Intervention of Inner Muscle Training of Female Amateur Basketball Players

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Abstract. [Purpose] The aim of this study was to investigate the changes of the athletic performance and the thickness of the transverse abdominal muscle (TAM) of the amateur basketball players by the single blind test after inner muscle training intervention. [Subjects and Methods] The subjects were 16 healthy females who were divided into two groups: a inner muscle training (IMT) group and a control group. The IMT group consisted of 8 subjects, and the control group consisted of 8 subjects. Participants in the IMT group performed TAM and pelvic floor muscles (PFM) co-contraction exercise. The thickness of the TAM, the side step test and the crossover dribble test were measured before and after 8 weeks of exercise. The thickness of the TAM was measured under 5 conditions: (1) at rest, (2) maximal contraction of the TAM, (3) maximal contraction of the PFM, (4) maximal co-contraction of both the TAM and PFM, and (5) maximal co-contraction of both the TAM and PFM using a Thera-band®. [Results] There were no significant differences among the results of the control group. In the exercise group, there were significant differences in the thickness of the TAM during maximal co-contraction of both the TAM and PFM using a Thera-band® and the side step test after the intervention. [Conclusion] The TAM and PFM co-contraction exercise intervention increases the thickness of the TAM. Since the side step times increased, the exercise may be recommended for the improvement of the performance of basketball players.

Keywords：Transverse abdominal muscle, Inner muscle training, Basketball

(This article was submitted August.9, 2020, and was accepted August.19, 2020)

1. INTRODUCTION

Several studies reported that the pelvic floor muscles (PFM), as the inner unit along with the transverse abdominal muscle (TAM), multifidus muscle, and diaphragm, acts to maintain the stability of the trunk, and the PFM has begun to be used in approaches for not only stress urinary incontinence (SUI) but also lumbar pain[1-3]. In our previous study, The TAM and PFM co-contraction exercise intervention increases the thickness of the TAM and may be recommended to improve SUI in middle-aged women[4]. This result suggests that changes in the thickness of the TAM may be used to indicate changes in the electrical activity of the PFM. The abdominal pressure is raised when TAM contracts. Therefore, it seems that the stability of the trunk and pelvis is improved. As a hypothesis, it is considered that simultaneous contraction training

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of the inner muscle including TAM is performed and it will contribute to the improvement of athletic performance.

The aim of this study was to investigate the changes of the athletic performance and the thickness of the transverse abdominal muscle of the amateur basketball players by the single blind test after 8 weeks inner muscle training intervention.

2. SUBJECTS AND METHODS

Subjects

The subjects were 16 female amateur basketball players who were divided into two groups randomly: a inner muscle training (IMT) group (n=8) and a control group (n=8). Subject characteristics are detailed in Table 1. They had played basketball for 10.5±2.0 years. All subjects were screened before the start of the study using out a medical history questionnaire. The questionnaire addressed whether subjects had a history of cardiopulmonary, musculoskeletal, somatosensory, or neurological disorders. If so, they were excluded from the study. All subjects gave their informed consent to participation in the study.

Methods

The thickness of the TAM was measured using ultrasound. The thickness of the TAM was measured in all subjects under seven conditions at random in the supine position. 1) The first condition was the resting state. 2) The second condition was maximal contraction of the TAM. For this, the subjects were instructed to draw in the lower abdominal wall toward the spine, an action that specifically activates the TAM. The subjects were asked to breathe in a relaxed manner. No movement of the lumbar spine was allowed. 3) The third condition was maximal contraction of the PFM. For this the subjects were instructed to contract the muscles around the vagina “like a drawstring” and to lift them internally. No posterior tilt of the pelvis was allowed. There was no instruction to either use or not use the abdominal muscles. 4) The fourth condition was maximal co-contraction of both the TAM and PFM. Subjects were instructed to draw in the lower abdominal wall toward the spine, an action that specifically activates the TAM. When the TAM sustained isometric contraction, the subjects were instructed to contract the muscles around the vagina "like a drawstring" to lift them internally and to keep this position for 5 seconds. 5) Maximal simultaneous contraction of both TAM and PFM with lateral resistance added to both knees using a Thera-band®. The resistance force during maximal simultaneous contraction of TAM and PFM was measured by two hand-held dynamometers (ANIMA uTas MT1, HHD) held in both knees inside of Thera-band®, using the tester function of HHD. The resistance force is controlled at 1.5kg.

Under each condition, the subjects were in the supine position with the knees flexed at 90° and a pillow under the head. A Stabilizer™ (Chattanooga group, inc.) was used to provide visual feedback. The Stabilizer™ provides pressure biofeedback during muscle re-education to determine whether the patient is able to selectively isolate and maintain contraction of the cervical or lumbopelvic core stabilization muscles. The three-chamber pressure cells were placed under the lumbar spine, and the subjects were asked to keep the baseline at 40 mmHg. If the pressure of the Biofeedback Stabilizer decreased under conditions 2, 3, 4 or 5, abdominal muscle re-education was provided by a physical therapist.

Ultrasound images of the anterolateral abdominal wall were obtained using a ultrasound (SonoSite 180PLUS, B mode, 5 MHz linear transducer). Gel was interposed between the transducer and the skin. The transducer was positioned adjacent to and perpendicular to the abdominal wall, 25 mm anteromedial to the midpoint between the ribs and ilium on the midaxillary line, and parallel to the muscle fibers of the transversus abdominis [5]. The same person, a midwife, made the measurements to avoid inter-rater errors. Ultrasound images were saved as still images. All thickness measurements were of muscle only, that is, between the fascia boundaries.

To measure the side step test, repeated sideways jumps were performed by drawing 3 lines at 1 m intervals, standing across the center line, and measuring how many side steps were possible in 30 seconds. The total number of completed jumps in the time period is recorded.

To measure the crossover dribble test, the cones are placed linearly up to 10 m at intervals of 2 m, and the subjects perform crossover dribble while carrying out basketball as quickly as possible, and the time is recorded.

These measurements were performed before the intervention, and 8 weeks after the intervention. As a

single blind test, the measurer performs measurement and instruction, subject grouping is unknown. All measurements were done by a physical therapist. Subjects in the exercise group were provided with an 8-week TAM and PFM co-contraction training with lateral resistance added to both knees using a Thera-band® program. The exercises prescribed were 40 repetitions (2 sets of 20 repetitions) of a 5-second co-contraction of both the TAM and PFM. The women were told to perform 1 session of exercise 3 times per week. The women in the control group were asked not to exercise at home during the study.

To determine whether there were differences between the exercise group and the control group, the independent t-test was performed on subject characteristics. The Mann-Whitney test was performed to investigate the differences between groups. The Friedman test and Wilcoxon test were performed to investigate the differences between before and after the intervention. Data were analyzed using SPSS Ver. 17.0 for Windows. The chosen level of statistical significance was 0.05.

3. RESULTS

There were no significant differences between the exercise group and control group subject characteristics or any measure before the intervention. Table 2 shows the results for the thickness of the TAM. There were significant differences in the thickness of the TAM during maximal co-contraction of both the TAM and PFM using a Thera-band® between before and after the 8 weeks exercise. And there was significant increase of the times of the side step test (table 3). In the control group, there were no significant differences after the intervention.

Table 1. Subject characteristics

	IMT [b] group (n= 8)	Control group (n= 8)
Age (years)	33.9 ± 3.8	31.6 ± 5.5
Height (cm)	162.2 ± 8.0	162.9 ± 6.5
Weight (kg)	61.5 ± 6.9	57.8 ± 8.5

Note: values are means ± standard deviation. There were no significant differences between groups at the 0.05 level.
[a] IMT: inner muscle training

Table 2. Comparison of the TAM[a] thickness between before and after intervention

	IMT [b] group (n=8)		Control group (n= 8)	
	Before	After	Before	After
Resting state	4.2 ± 0.8	4.4 ± 0.7	3.7 ± 0.6	4.2 ± 1.1
Maximal contraction of TAM	6.1 ± 1.3	6.5 ± 0.7	6.4 ± 1.6	6.1 ± 2.1
Maximal contraction of PFM [c]	5.6 ± 1.0	5.6 ± 0.7	6.3 ± 1.8	5.4 ± 1.5
Maximal co-contraction [d]	6.1 ± 1.1	6.9 ± 0.5	7.2 ± 1.8	6.4 ± 1.8
Maximal co-contraction [d] using a Thera-band®	6.2 ± 1.1	7.6 ± 0.8*	7.7 ± 1.3	6.8 ± 2.0

Note: values are means ± standard deviation (unit: mm). *$p < 0.05$ (before and after 8 weeks).
[a] TAM: transverse abdominal muscle.
[b] IMT: inner muscle training
[c] PFM: pelvic floor muscle.
[d] Maximal co-contraction: maximal co-contraction of both the TAM and PFM.

Table 3. Comparison of fitness tests between before and after intervention

	IMT [a] group (n= 8)		Control group (n= 8)	
	Before	After	Before	After
Side step test (times)	62.6 ± 4.5	65.0 ± 4.6*	63.3 ± 5.7	64.7 ± 3.4
Crossover dribble test (sec)	4.1 ± 0.5	3.8 ± 0.2	3.8 ± 0.4	3.9 ± 0.5

Note: values are means ± standard deviation.
*$p < 0.05$ (before and after 8 weeks).
[a] IMT: inner muscle training

4. DISCUSSION

The exercise group subjects showed not only an increased thickness of the TAM during maximal co-contraction of both the TAM and PFM but also improved the athletic performance. In our previous study, the muscle output during simultaneous contraction and resistance movement were larger than that of each individual muscle [6].

The TAM was contracted by "belly-in" and the pelvis was in retroversion, raising the intra-abdominal pressure. The TAM contraction is a resistance exercise with raised intra-abdominal pressure which increases PFM contraction. Therefore, the strength training effect of the PFM while TAM is contracted is greater than that of individual muscle contraction. In addition, the internal obturator muscle, which is the hip external rotator muscle, was contracted by resistance exercise using a Thera-band®. The internal obturator muscle was connected to the levator ani muscle at the pelvic obturator foramen, and we believe that contraction of the internal obturator muscle promotes levator ani muscle contraction.

The increased times of the side steps is considered to improve agility. Since inner muscle training was performed, the stability of the lower trunk was improved, and the agility movement ability was improved. Therefore, the inner muscle training is effective for improving performance in basketball with many direction-changing movements. Inner muscle training as a warm-up is thought to help prevent injuries.

The TAM and PFM co-contraction exercise intervention increases the thickness of the TAM. Since the side step times increased, the exercise may be recommended for the improvement of the performance of basketball player.

The limit is to consider how to control the resistance of the Thera-band®. Further investigations will be need to weigh the training effect for women with urine incontinence in a prospective intervention study.

Funding and Conflict of interest

No funding was provided for this study. The author declares no conflict of interest.

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The author is grateful to the subjects and co- author for assistance with data acquisition.

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Original Article

Factors of Depression Related to Living Habits in Healthy College Students under the Declared State of an Emergency

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Abstract. [Purpose] The objective of this study was to clarify the related factors of depression in healthy college students during the declared state of emergency over the coronavirus disease 2019 pandemic. [Subjects and Methods] 85 healthy, young adults aged 20.1 ± 0.4 (mean ± standard deviation) years were enrolled. A questionnaire survey on living habits and depression during the emergency was conducted from April 18, 2020, to April 24, 2020. [Results] Analysis of the results showed 46 (54%) participants lost their part-time jobs and 21 (25%) had decreased work time. Only 9 (11%) participants were not influenced by work loss. Logistic regression analysis showed that depression was independently associated with study hours (odds ratio = 0.36) and sleep duration (odds ratio = 0.24). [Conclusion] In many healthy college students who lost part-time work or had decreased work, study hours and sleep duration were associated with the presence of depression during the declared state of emergency.

Keywords：declared state of emergency, living habits, depression

(This article was submitted July.30, 2020, and was accepted August.20, 2020)

1. INTRODUCTION

In Japan, based on the Act on Special Measures Concerning Coronavirus Disease 2019 (COVID-19), by which an emergency declaration was enacted on March 13, 2020, the Prime Minister can designate the period and the extent to which he takes urgent measures as the occasion for national safety. A prefectural governor in a target area can request the cooperation necessary to prevent the spread of infection, including self-control, meaning residents only go out for living maintenance[1)]. Using one of the special measures law of the COVID-19 measures, the 7th prefecture declared a state of emergency on April 7, 2020[2)], and a state of emergency was declared nationwide on April 16, 2020[3)].

The International University of Health and Welfare's entrance ceremony was canceled due to the COVID-19 measure, and the semester's commencing time was delayed for about 2 weeks. On April 16, 2020, 42 people tested positive for COVID-19 in the Tochigi Prefecture. The state of emergency special measures was experienced for the first time and had a significant influence on college students as they could not attend university. The influence of the special measures on living habits was also unclear. Thus, it is necessary to clarify the living habits of healthy college students during an emergency declaration due to the COVID-19 pandemic. Several studies report that 66 - 76% of college students had part-time jobs[4,5)], but it is unclear whether they could continue to work after the emergency declaration. When healthy

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college students were going out during self-control, the influence it had on living habits, meals, sleep duration, and frequency of exercise was unclear. The continuation of studies at a university may become difficult and students may register absences from school and leave school due to depression. In addition, many students require economic stability through a part-time job.

The prevalence data indicate that 7% of adults in the United States in 2016 met the Diagnostic and Statistical Manual of Mental Disorders-Ⅳ (DSM-Ⅳ) criteria for major depressive episodes [6]. Mitchell (2010) and Guerin (2018) recommended the use of the Geriatric Depression Scale 15 (GDS-15) for routine depression screening in primary medical care settings[7,8]. Ferraro (2011) used the GDS-15 in studies of college-aged men and women with clinical phenomena as disordered eating, phobias, and experimental mood induction[9]. Validating the use of GDS-15 with younger adults would also enable both clinicians and researchers to use a single screening measure across the adult lifespan. The GDS-15 is a short depression rating scale that demonstrates good diagnostic sensitivity and specificity for adults aged 18 years and older[8].

Thus, the prevalence of depression would be higher in college students when they are limited from going out under self-control due to COVID-19. The purpose of this study was to clarify the factors of depression associated with living habits in healthy college students under the emergency declaration due to the COVID-19 pandemic.

2. SUBJECTS AND METHODS

92 participants (56 males and 36 females) who were in their third year in the physical therapy department were enrolled in the study. 3 participants who did not provide consent, 3 participants with whole internal use treatment or a poor physical condition, and 1 participant who was a member of the society entrance were excluded from the study. The final 85 participants (51 male and 34 female) had a mean age of 20.1 (standard deviation 0.4) years. The questionnaire survey was a web questionnaire concerning living habits during the period when the emergency was declared. Participants were informed that the questionnaires were optional and did not influence their results. The questionnaire contents included the following: gender, age, residential area, residential environment, frequency of part-time job, influence of part-time job after the emergency declaration, exercise frequency, exercise time, going out frequency, drinking frequency, smartphone usage time, social networking service (SNS) usage time, the viewing time of YouTube, study hours, sleep duration, food requirement, and responses to the GDS-15. To clarify the factors of depression relating to living habits under the emergency declaration condition, the questionnaire survey was conducted from April 18, 2020, to April 24, 2020. The questionnaire had 3 possible answers: “decreased”, “no change”, and “increased”. The GDS-15 had 15 items with choices of “Yes” or “No”. The GDS-15 had 15 items with choices of “Yes” or “No”. The GDS-15 was administered in a self-report and scored using the standard cutoff score of 5, in which a score of 5 or greater indicated the presence of clinically significant symptoms of depression[8]. To access the correlation coefficient between depression and living habits, Spearman’s rank correlation coefficient was used. Difference between no depression group and depression group were analyzed using the Fisher’s exact test. To access the multicollinearity, correlation coefficient between living habits were assessed using Spearman’s rank correlation coefficients. Logistic regression analysis was performed to determine which variables were independently associated with depression. To prevent the arbitrary operation of the author, the explanatory variables were all questions. There was no variable of the correlation coefficient $|r| > 0.7$. As dummy coding, the male assumed 0, female 1. Logistic regression analysis using the forced injection method was conducted; $P < 0.05$ was considered statistically significant. IBM SPSS Statistics version 25 (IBM Corp., Armonk, NY, USA) was used for statistical analysis. This study complied with the ethical standards of the Declaration of Helsinki and was approved by the Ethics Committee of the International University of Health and Welfare (approval number: 20-Io-24).

3. RESULTS

The characteristics of participants are shown in Table 1. Participants were either living in Tochigi Prefecture (n=79; 93%), or living alone (n=69; 81%). 46 participants (54%) lost their part-time jobs and 21 (25%) had decreased work time under the declared state of emergency. Only 9 participants (11%) were not influenced by the loss of their part-time job. 27 participants (32%) who were not depressed and 58 participants (68%) who were depressed were distinguished using a standard cutoff score of 5. Table2 showed that there was no correlation between depression and living habits. And Table 3 indicated the no significantly difference between no depression group and depression group. Table 4 showed that there was no multicollinearity between the independently variables. Table 5 shows the logistic regression analysis results with depression as a dependent variable. Study hours (odds ratio = 0.36) and sleep duration (odds ratio = 0.24) were independently associated with depression ($P < 0.05$).

Table1. Subject characteristics

age(years)	20.1±0.4	
gender	n	%
male	51	60%
female	34	40%
residential area		
Tochigi prefecture	79	93%
others	6	7%
residential environment		
alone	69	81%
with family	16	19%
frequency of part-time job		
none	59	69%
1 or 2 times per week	15	18%
3 or 5 times per week	11	13%
6 or 7 times per week	0	0%
influence to part-time work after an emergency declaration		
lost	46	54%
time decreased	21	25%
change	2	2%
no influence	9	11%
originally no part-time	7	8%
exercise frequency		
0 time per week	30	35%
1 or 2 times per week	25	29%
3 or 4 times per week	16	19%
5 times per week or more	14	16%
Relative change after the state of emergency		
going out frequency		
decreased	82	96%
no change	3	4%
increased	0	0%
drinking frequency		
decreased	54	64%
no change	24	28%
increased	7	8%
smartphone usage time		
decreased	0	0%
no change	4	5%
increased	81	95%
SNS usage time		
decreased	1	1%
no change	18	21%
increased	66	78%
viewing time of YouTube		
decreased	0	0%
no change	22	26%
increased	63	74%
study hours		
decreased	17	20%
no change	47	55%
increased	20	24%
no response	1	1%
sleep duration		
decreased	4	5%
no change	32	38%
increased	49	58%
exercise time		
decreased	35	41%
no change	24	28%
increased	25	29%
no response	1	1%
food requirement		
decreased	21	25%
no change	55	65%
increased	8	9%
no response	1	1%

Table3. Comparison between no depression group and depression group

	no depression group	depression group	p value
gender	n	n	
male	16	35	1.00
female	11	23	
residential area			
Tochigi prefecture	20	49	0.37
others	7	9	
residential environment			
alone	26	53	0.67
with family	1	5	
frequency of part-time job			
none	17	42	0.45
1 or 2 times per week	5	10	1.00
3 or 5 times per week	5	6	0.32
going out frequency			
decreased	26	56	1.00
no change	1	2	
drinking frequency			
decreased	19	35	0.47
no change	7	17	0.80
increased	1	6	0.43
smartphone usage time			
no change	2	2	0.59
increased	25	56	
SNS usage time			
decreased	1	0	0.32
no change	8	10	0.26
increased	18	48	0.16
viewing time of YouTube			
no change	5	17	0.43
increased	22	41	
study hours			
decreased	2	15	0.08
no change	16	31	0.64
increased	8	12	0.41
sleep duration			
decreased	1	3	1.00
no change	8	24	0.34
increased	18	31	0.35
exercise time			
decreased	10	25	0.81
no change	9	15	0.44
increased	7	18	0.80
food requirement			
decreased	7	14	0.79
no change	17	38	1.00
increased	2	6	1.00

p value: Fisher's exact test

Table2. Correlation between depression and independence variables

	gender	residential environment	residential area	frequency of part-time job	going out frequency	drinking frequency	smartphone usage time	SNS usage time	viewing time of YouTube	study hours	sleep duration	exercise time	food requirement
correlation coefficient (ρ)	-0.01	-0.12	0.09	-0.11	-0.01	0.11	0.09	0.19	-0.11	-0.20	-0.12	-0.01	0.04
p value	0.93	0.26	0.42	0.33	0.95	0.31	0.43	0.09	0.30	0.07	0.26	0.95	0.70

Data are expressed as Spearman's rank correlation coefficient (ρ)

Table4. Correlation between independence variables

	gender	residential environment	residential area	frequency of part-time job	going out frequency	drinking frequency	smartphone usage time	SNS usage time	viewing time of YouTube	study hours	sleep duration	exercise time	food requirement
gender	1	-0.22	0.07	0.08	0.19	-0.06	-0.29	-0.15	0.22	0.14	-0.01	0.04	-0.37
residential environment	-0.22	1	-0.19	-0.17	0.00	-0.20	0.08	-0.07	-0.09	-0.10	0.12	-0.09	0.11
residential area	0.07	-0.19	1	0.12	-0.08	-0.10	-0.14	-0.28	-0.02	-0.04	0.29	-0.01	-0.16
frequency of part-time job	0.08	-0.17	0.12	1	-0.05	0.01	-0.20	-0.10	0.17	0.16	-0.05	0.05	-0.12
going out frequency	0.19	0.00	-0.08	-0.05	1	0.00	-0.07	0.27	-0.07	0.15	-0.19	0.05	-0.10
drinking frequency	-0.06	-0.20	-0.10	0.01	0.00	1	0.18	0.17	0.02	0.04	-0.04	0.05	0.22
smartphone usage time	-0.29	0.08	-0.14	-0.20	-0.07	0.18	1	0.16	-0.07	-0.06	-0.11	-0.21	0.13
SNS usage time	-0.15	-0.07	-0.28	-0.10	0.27	0.17	0.16	1	-0.04	-0.03	-0.46	-0.10	0.12
viewing time of YouTube	0.22	-0.09	-0.02	0.17	-0.07	0.02	-0.07	-0.04	1	0.11	0.03	-0.13	-0.15
study hours	0.14	-0.10	-0.04	0.16	0.15	0.04	-0.06	-0.03	0.11	1	0.26	0.10	-0.13
sleep duration	-0.01	0.12	0.29	-0.05	-0.19	-0.04	-0.11	-0.46	0.03	0.26	1	0.20	-0.09
exercise time	0.04	-0.09	-0.01	0.05	0.05	0.05	-0.21	-0.10	-0.13	0.10	0.20	1	0.06
food requirement	-0.37	0.11	-0.16	-0.12	-0.10	0.22	0.13	0.12	-0.15	-0.13	-0.09	0.06	1

Data are expressed as Spearman's rank correlation coefficient (ρ)

Table5. Logistic regression analysis for depression

	β	Standard error	p value	Exp(β)	EXP(β) 95% CI	
gender	-0.52	0.65	0.43	0.59	0.17 —	2.14
residential environment	-0.67	0.75	0.37	0.51	0.12 —	2.23
residential area	0.04	1.38	0.98	1.04	0.07 —	15.47
frequency of part-time job	-0.53	0.38	0.17	0.59	0.28 —	1.25
going out frequency	0.31	1.42	0.83	1.37	0.08 —	22.35
drinking frequency	0.41	0.51	0.42	1.51	0.55 —	4.10
smartphone usage time	1.59	1.19	0.18	4.90	0.47 —	50.83
SNS usage time	1.36	0.75	0.07	3.91	0.90 —	16.92
viewing time of YouTube	-0.92	0.73	0.20	0.40	0.10 —	1.66
study hours	-1.01	0.47	0.03	0.36	0.14 —	0.92
sleep duration	-1.31	0.66	0.05	0.27	0.07 —	0.98
exercise time	-0.19	0.35	0.59	0.83	0.42 —	1.65
food requirement	0.46	0.55	0.40	1.59	0.54 —	4.66
Intercept	1.40	5.03	0.78	4.05		

4. DISCUSSION

In this study, we administered a questionnaire survey during the declared state of emergency in Japan. Before the COVID-19 pandemic, of the Japanese college students, 51% lived at home while attending school, and 49% lived outside their home in college students' rooms. The part-time job working rate was 76% (living at home 81% and boarding 72%) [10], and the average weekly working time for part-time jobs was 13 hours[8]. This study demonstrated that many students lived alone (n=69; 81%) and particularly in the Tochigi Prefecture (n=79; 93%). Other studies found a part-time job working rate of 67-76%[4,5], which is lower than that of participants in this study. 46 participants (54%) lost their part-time job after the declared state of emergency. University classes had not started during the period of the questionnaire, and the emergency declaration for COVID-19 expansion prevention was more influential than schoolwork. We found 82 participants (96%) had decreased frequency of going out, and 81 participants (95%) had increased smartphone usage time. It seemed that smartphone usage time increased when they did not go out. Takenoshita (2011) reported that there were less sleeping hours for students with high part-time job hours per week[11]. Thus, when a part-time job was lost or work was ceased, the sleeping hours of students increased.

In this study, 27 participants (32%) were not depressed, and 58 participants (68%) were depressed, which is a high proportion. Anxiety had a significant influence on lifestyle changes during the declared emergency. This study indicated that sleep duration and study hours were associated with depression in college students under the declared state of emergency. That is, a person with depression has short sleeping hours and study hours. Participants who lost their part-time jobs or had deceased working time were not able to study hard and sleep well. A previous study showed that sleep duration is associated with depression in adults and in college students[12,13,14]. The exercise frequency, exercise time, going out frequency, drinking frequency, smartphone usage time, SNS usage time, viewing time of YouTube, and food requirements were not related to depression. This study showed that study hours and sleep duration were strongly associated factors of depression.

In conclusion, in many healthy college students who lost part-time work or had decreased work, study hours and sleep duration were associated with the presence of depression under the emergency declaration condition due to the coronavirus pandemic.

This study has several limitations. We did not know the baseline scores for the GDS-15 in participants. If they go out freely, we need to re-measure the GDS-15. Tochigi Prefecture has little influence on the COVID-19 pandemic worldwide. Therefore, our results should be interpreted carefully. The diagnosis using the DSM-IV was not assessed. The GDS-15 was validated as an alternative index for symptoms of depression and may have affected the accuracy of diagnosis for depression. As this study was a cross-sectional analysis, conclusions concerning cause-and-effect relationships were not drawn. Another limitation is the selection bias of the sample. Finally, it was necessary to collect the more data. It had little number of participants for Logistic regression analysis.

Funding and Conflict of interest

No funding was provided for this study. The author declares no conflict of interest.

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Case study

Rehabilitation Effects after Knee Arthroplasty in a core hospital in the local area in China

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Abstract. [Purpose] With the progress of aging population in China, rehabilitation has also entered a phase of rapid development. However, for general rehabilitation treatment, previous studies suggest that China is not so good compared with other countries. For the further development of rehabilitation in China, the aim of this study was to investigate the efficacy of rehabilitation for the total knee arthroplasty (TKA) in China. [Subjects/Methods] Twenty patients with TKA (nine males and 11 females; the average age was 69.8 ± 5.4 years) participated in this study. To assess the treatment's process and efficacy of the rehabilitation after TKA operation, the length of stay, the visual analog scale for pain (VAS), active range of motion (aROM), and Time up and Go (TUG) test were performed before and after rehabilitation. All data after TKA except the length of the stay in the hospital were normalized with those before TKA, and thus, those values were presented as a percentage. [Results] The average length of hospitalization was 7.7 days. Although VAS and TUG after the TKA increased significantly compared with those before the TKA, both tests gradually decreased significantly with the intervention of rehabilitation. The aROM was limited after the TKA, but recovered to be near aROM before the TKA after the rehabilitation for 1 month. [Conclusion] The rehabilitation performed for patients with the TKA is also developing in the rural private hospital in China.

Keywords：Rehabilitation, Total knee arthroplasty, China

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1. INTRODUCTION

In China, with the economic development and the westernization of life, life expectancy and obese individuals have increased[1)]. Recently, the number of patients with knee osteoarthritis also caused by aging and obesity has increased in China[2)]. Total knee arthroplasty (TKA) operation is an effective treatment for symptomatic end-stage degenerative knee arthritis[3)]. Therefore, a large number of TKA operations have been performed in China and rehabilitation after TKA is important to improve not only functional aspects but also the Quality of life.

Rehabilitation medicine in China started in 1980's[4)] while that in Japan started in 1960's[5)]. Although Chinese public hospitals were required to set up rehabilitation departments from 1996, the level of

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orthopedic rehabilitation in China is reported to be not high and enough[6]. Although this may be related to the insufficient development of rehabilitation treatment, one possible explanation is the difference of the composition of therapists for the rehabilitation in China[7]. Various professionals (e.g., physical therapists, occupational therapists, speech therapists, etc.) collaborate for the rehabilitation in many countries, but in China, rehabilitation therapists do all the therapeutic work. To be a rehabilitation therapist, they have to learn not only the physical therapy but also other therapies. Thus, this may result in time insufficiency to master the professional knowledge and skill of each therapy and it is not clear whether rehabilitation therapists have the potential ability sufficiently as the physical therapists or not.

Another characteristic of rehabilitation in China is to add the traditional Chinese treatments (e.g., acupuncture, massage, qigong, etc.) to the rehabilitation program[8]. Historically, the Tai-chi has been mainly practiced as exercise therapy in China. Further, the rehabilitation therapy in a core hospital in the local area in China seems to improve gradually through introducing western medicine, for example, stretching and resistance training. Thus, from the world-wide viewpoint, it is needed that the rehabilitation therapy in China is verified about the outcome and efficacy for orthopedic diseases, especially, for the TKA, as the standard physical therapy.

As mentioned above, rehabilitation medicine in China started late[6] and at present, the physical therapy in China is not a member of World physiotherapy. Thus, the level of rehabilitation in China is unclear in view of the world standard. On the other hand, the rehabilitation in Japan develops from near time with Europe and the United States and the physical therapy has a high level among Asia countries relatively[9]. The various professional staffs work in the rehabilitation in Japan and physical therapists carry out the rehabilitation for patients with TKA mainly. Therefore, rehabilitation and physical therapy in Japan may be one model for those in China. The purpose of this study was to evaluate Chinese rehabilitation treatment as the standard physical therapy by investigating the recovery by the rehabilitation therapy after TKA in a core hospital in the local area and comparing relevant literature data between China and Japan. We hypothesized that the recent level of the rehabilitation in China was near to that in Japan.

2. SUBJECTS AND METHODS

Subjects

This study was performed in one core hospital and twenty patients with lateral TKA participated (Nine males and 11 females; mean age: 69.8 ± 5.4 [standard deviation; SD] years; mean height: 163.2 ± 7.4 cm; mean weight: 65.7 ± 13.0 kg). Inclusion criteria includes the followings: 1) underwent first TKA; 2) same operative methods; 3) conscious and without cognitive impairment. Exclusion criteria includes the followings: 1) with serious cardiovascular disease, neurological disease, osteoporosis and metabolic disease; 2) suffering from hemophilia, sever diabetes, tumor, or function of blood coagulation disorder; 3) with fracture, dislocation, abnormal structure, and other surgeries. All participants provided written informed consent and their information regarding with rehabilitation were used anonymously in this study, and the procedures were approved by the research ethics committee (no. 18 - 65).

Intervention

The orthopedic surgeon reported that operative methods of TKA for all patients in this study was standard in the world. The rehabilitation program adjusted for each patient was custom-made by his/her rehabilitation therapist. To assure the common program performed generally in Chinese hospitals, specific instructions regarding to both traditional Chinese and western medicine treatments for the TKA were not given to rehabilitation therapists. Therefore, rehabilitation programs for each patient were selected and carried out mixed traditional Chinese and western medicine treatments, including on ROM-ex, stretching, muscle strength training, continuous passive motion (CPM), massage, Transcutaneous Electrical Nerve Stimulation (TENS), etc., on the basis of symptoms after TKA. Patients were permitted to have some rests freely during training if needed, and rest times were not limited. Also, rehabilitation therapists had always checked patient's condition and recovery and rehabilitation program was adjusted as they arose. Considering patient's physical condition, postoperative rehabilitation time was short at the bedside, while that in the exercise room was relatively long as the postoperative rehabilitation was performed

aggressively (however, total time duration in rehabilitation was not exceeded over 1 hour). After discharge, if necessary, rehabilitation therapies were carried out as outpatients.

Outcome measurements

The length of stay was counted for each patient. The criteria for discharge in this hospital was following: the visual analog scale for the knee pain (VAS-p) is under 50 mm; the gait distance is over 70 m using any walking support devices; independence of self-activities (e.g., wearing, toilet activity, etc.) [10]. To assess the efficacy of both the TKA and its rehabilitation, the VAS-p, the test of active range of motion for the affected knee (aROM-t), and Time Up and Go test (TUG-t) were measured before (i.e., baseline) and after the TKA. The VAS-p was performed with the 100 mm line on the white paper, which meant 0 mm as no pain and 100 mm as severe pain, and patients were asked to mark the level of pain that they felt for knee. The distance between the marked point and the 0 point of the line was measured in mm, and the numerical value obtained was recorded. The knee aROM-t was measured with a manual goniometer in a sitting position through this rehabilitation since patients could not keep the prone position after TKR. The angle difference between the patient's maximum active flexion and knee 0 ° was recorded as the knee aROM. For the TUG-t, patients were asked to perform a series motor task as possible fast, which consists of standing up without using their arms, walking for 3 m, turning around, walking to return, and sitting down. Patients were permitted to use walking support aids if needed. The period from the start to the end was recorded with the stopwatch. These measurements were performed at postoperative hour 12, day 3, week 1, week 2, and month 1. Furthermore, after the discharge, patients were examined these tests as outpatients.

Statistical analysis

Statistical analysis was performed with SPSS Statistics version 18.0 (IBM Corp., Armonk, NY, USA). The length of stay was presented mean value ± SD for all patients. Also, all measurement values after TKA were normalized with the baseline value before TKA and presented as percentage. The repeated-measure one-way analysis of variance (ANOVA) for each test was performed to examine the efficacy of the TKA and its rehabilitation. Post hoc analysis was performed a multiple-comparison using Bonferroni corrections. All significant levels were set at $p < 0.05$, and trends or approaching significances were noted when $0.05 < p < 0.1$.

3. RESULTS

The average length of stay was 7.7 ± 1.2 (range: 6-10) days in this study. There was a main effect of the time on the VAS-p ($F (2, 42) = 67.57$, $p < 0.01$, $\eta 2 = 0.781$). Post hoc test showed a significant difference between the baseline and postoperative hour 12 ($p < 0.01$), day 3 ($p < 0.01$), week 1 ($p < 0.01$), week 2 ($p < 0.01$), and month 1 ($p < 0.01$) (Table 1) and the VAS-p during postoperative hour 12 increased and others decreased more than that during the baseline.

Table 2 showed the aROM-t of affected knee during before and after the TKA. There was a main effect of the time on the aROM-t ($F (6, 114) = 149.44$, $p < 0.01$, $\eta 2 = 0.887$). Post hoc test showed a significant difference between the baseline and postoperative hour 12 ($p < 0.01$), postoperative hour 48 ($p < 0.01$), postoperative 3 day ($p < 0.01$), and postoperative week 1 ($p < 0.01$), and the aROM-t until postoperative week 1 had decreased. Although there was no significant difference in the aROM-t between the baseline and postoperative week 2 and month 1, the aROM-t at postoperative month 1 was over that at the baseline in all patients except for 3 patients.

Two patients could not walk before the TKA and six patients could not walk until postoperative week 1. The rest of twelve patients were permitted to perform the first walk using any gait supporting devices from postoperative day 3. Therefore, this study used data of these twelve patients for performing the repeated-measure one-way ANOVA. There was a main effect of the time on the TUG-t ($F (2, 24) = 93.67$, $p < 0.01$, $\eta 2 = 0.895$). Post hoc test showed a significant difference between the baseline and postoperative day 3 ($p < 0.01$), week 1 ($p < 0.01$), and month 1 ($p < 0.01$) (Table 3). The TUG-t until postoperative week 1 was increased and that during postoperative month 1 decreased more than that during the baseline. There was no significant difference in the TUG-t between the baseline and postoperative week 2.

Table 1 Visual Analog Scale for pain

Pre-TKA	Post-12 hours	Post-24 hours	Post-3 days	Post-1 week	Post-2 weeks	Post-1 month
38.5 ± 1.3	46.0 ± 0.9	35.5 ± 1.9	29.5 ± 2.1	21.5 ± 2.5	17.0 ± 3.1	11.0 ± 5.4
(%)	(128.6 ± 34.2*)	(98.7 ± 30.1)	(81.8 ± 23.1*)	(81.8 ± 23.1*)	(44.3 ± 15.5*)	(25.7 ± 21.3*)

Upper lines present absolute vales (unit: mm) and lower lines present percentages (unit: %). Means with standard deviation. Total knee arthroplasty (TKA). * indicates a statistically significant difference between pre-TKA and each time ($p < 0.05$).

Table 2 Active range of motion test

Pre-TKA	Post-12 hours	Post-24 hours	Post-3 days	Post-1 week	Post-2 weeks	Post-1 month
96.5 ± 13.8	36.0 ± 14.2	47.5 ± 13.7	60.5 ± 15.7	79.5 ± 14.5	93.6 ± 6.9	102.0 ± 8.9
(%)	(37.0 ± 11.9*)	(49.2 ± 11.7*)	(63.2 ± 16.3*)	(83.0 ± 13.9*)	(98.7 ± 14.5)	(107.1 ± 13.0)

Upper lines present absolute vales (unit: degree) and lower lines present percentages (unit: %). Means with standard deviation. Total knee arthroplasty (TKA). * indicates a statistically significant difference between pre-TKA and each time ($p < 0.05$).

Table 3 Time Up and Go test

Pre-TKA	Post-3 days	Post-1 week	Post-2 weeks	Post-1 month
19.9 ± 3.0	27.5 ± 2.2	22.5 ± 2.2	18.8 ± 1.8	15.7 ± 1.9
(%)	(140.5 ± 17.0*)	(114.5 ± 11.2*)	(95.9 ± 12.2)	(80.0 ± 12.6*)

Upper lines present absolute vales (unit: second) and lower lines present percentages (unit: %). Note that the number of patients was twelve (see "Results"). Means with standard deviation. Total knee arthroplasty (TKA). * indicates a statistically significant difference between pre-TKA and each time ($p < 0.05$).

4. DISCUSSION

In this investigation in the core hospital in Chinese local city, the average length of stay of patients with the TKA was about 1 week. Comparable literatures in China and Japan reported that the average length of stay in China[11-14] was 6.7 to 21 days, while that in Japan[15-19] was 17.1 to 28.2 days. Especially, the length of stay in this study was close to that (6.7 days) reported the recent study by Yu K, et al.[14] and this length of stay was closer to the standard of the fast-track rehabilitation after TKA[20]. However, although early discharge by the fast-track rehabilitation could reduce the medical cost, sometimes it is not enough to recover mobility and knee ROM after TKA[20]. Overall, the length of day for the TKA in China is trend to be short more than that in Japan. This trend may be related to a medical policy based on the scale of economy in each country and the criterion for discharge in each hospital[21]. Additionally, there may be an individual difference in the economy state. Therefore, it is necessary to verify not only the length of hospitalization but also the functional recovery of knee or related motor performances to verify the efficacy of rehabilitation.

The major complaint in patients with knee osteoarthritis is a knee pain under variable situation. The knee pain has increased following the TKA in this study and it has turned toward decrease from postoperative day 3 of the TKA. The knee pain in this study is comparable to or higher than that in other studies in China and however, those were similar at 1 month. The knee pains at postoperative day 3 of TKA in this study (77%) and previous studies (30 – 77%)[22-25] in China were great variability, and those were near same level at postoperative month 1 (this study: 29%; previous studies[22,24]: 24 – 38%). Regarding Japan, a previous

study[26] reported similar results to our current study. Another study[27] in Japan reported that the knee pain at postoperative day 3 of the TKA increased approximately three times as that before the TKA and then, it decreased to the level of pre-operation at about postoperative week 3. Probably, it is possible that the knee pain affects by the operation methods and the use of postoperative analgesics until postoperative day 3 of the TKA[28]. Rehabilitation therapy in China also seems to decrease the knee pain after the TKA similar to that in Japan.

Including of this study, several studies in China and Japan showed that knee ROM recovered to approximately 85% of the pre-operation ROM by postoperative week 1 – 2 from the TKA[11, 16, 17, 22-27] and improved more than the pre-operation ROM at postoperative month [18, 25-28]. Though the final ROM recovery is depended by the initial ROM before TKA and operative procedure of TKA, our outcomes of aROM was similar to those by a systematic review and meta-analysis[29]. However, considering activities of daily living, our outcomes of aROM is not still enough, continued rehabilitation is necessary on an outpatient basis before and after TKA.

In this study, although the TUG-t at postoperative week 1 of the TKA took more time than that before a surgery, its time was shortening after postoperative week 2. The TUG test reported in China[23] had been measured only at postoperative week 1 of the TKA and its score had taken approximately twice the time compared with time at the pre-operation, whereas our scores in this study were under 150%. The score of the TUG test at postoperative week 2 in this study (96%) was higher than those in two Japanese studies (91%[17] and 75%[18]). However, comparable data with our outcomes about the mobility were scarce in Chinese other papers and it is necessary that further studies focus on other assessments, especially, the motor performance (e.g., 10 m gait, TUG, 6 minutes shuttle walk, etc.) in China.

Literatures before 2014 presumed that orthopedic rehabilitation in China is still at a relatively backward level[6]. In order to improve the quality of the rehabilitation in China more, this study has verified the effect of the rehabilitation therapy for knee osteoarthritis at present. Since the current study was performed in the certain hospital in one local city, our results would reflect the general level of rehabilitation in China. Our findings suggest that rehabilitation in China has absolutely developed step by step. In the future, it is necessary to examine not only knee function and motor performance but also the quality of life for patients with TKA.

There were several limitations in this study. First, the sample size was small because this study was performed in a core hospital in the local city. The core hospital must receive lots of patients with various disease except of the TKA. Secondary, Chinese rehabilitation was compared with Japanese rehabilitation as the representative country in Asia because Japan has adopted the western rehabilitation in advance of other countries in Asia. In further study, rehabilitation in China should be compared with those in other advanced countries, for example, America, Canada, Australia etc., following to Japan. To our knowledge, evidences about efficacy of clinical rehabilitation in China, especially in rural hospitals have not been shown, since clinicians and therapists have no enough time to collect and analyze data. This study is the first study examined the efficacy of rehabilitation for the TKA performed in the local core hospital. Further study in rural China is required to understand the real situation of the efficacy of rehabilitation in overall China.

Funding and Conflict of interest

The authors have no conflicts of interest to declare for this research.

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