

CLINICAL STUDY

The impact of COVID-19 pandemic on the rehabilitation of patients after arthroscopic knee surgery at IPRM in UCM Maribor, Slovenia

CIMERMAN Maja¹, JESENSEK PAPEZ Breda²

Department of Physical and Rehabilitation Medicine, General Hospital Murska Sobota, Murska Sobota, Slovenia. maja.cimerman84@gmail.com

ABSTRACT

OBJECTIVES: We wanted to analyze the impact of the pandemic on the treatment and rehabilitation of these patients.

BACKGROUND: The COVID-19 pandemic has had a major impact on medical services globally and it also affected the field of elective surgery and rehabilitation medicine. Among the most common procedures is the arthroscopic knee surgery, which is an intervention that warrants postoperative physical therapy.

METHODS: The study included 105 patients subdivided in three groups, namely those treated before the pandemic, those treated during lockdown and those treated during the pandemic. We compared the decline in the number of patients and the rehabilitation outcome of the referred patients. The rehabilitation outcome was assessed by measuring the range of knee flexion.

RESULTS: There were 132 patients included in the analysis of the decline in the number of referred patients during the pandemic. The decline was 36 %. Out of these patients, 105 were included in the analysis of the effectiveness of rehabilitation, and we demonstrated that there were no statistically important differences in improvement among the groups ($p=0.246$).

CONCLUSION: Shorter treatment due to the COVID-19 pandemic did not have a statistically significant effect on the achieved knee flexion, but we noticed a reduction in the number of patients referred to our ward after knee arthroscopy (Tab. 6, Ref. 14). Text in PDF www.elis.sk

KEY WORDS: knee arthroscopy, rehabilitation, COVID-19, impact of pandemic.

Introduction

Since the outbreak of the COVID-19 pandemic, all areas of medical services have been gravely affected, including the areas of elective surgery and physical and rehabilitation medicine, as was also shown by Ferahman et al. (1). Many physiatrists have been reassigned to work on the front lines, and outpatient practices were cancelled or converted to telemedicine visits in order to prevent the possible spreading of the virus, as well as because of reorganization due to the need of reassigning the working personnel or need of facilities for the treatment of COVID-19 patients (2, 3, 4, 5, 6). This has become true also for Slovenia and our ward since the first declaration of the pandemic. Strict measures of minimizing contacts were introduced, which led to reducing the number

of patients in session at the same time. Consequently, the overall number of physiotherapy sessions was also reduced (5). Because of these measures, we had to change our strategy when treating all referred patients so that every referred patient would undergo physical therapy.

Arthroscopic surgery is among the most commonly performed orthopedic procedures. In the time of the pandemic, studies have recommended a more conservative approach and postponement of elective procedures (7). Goyal et al. found that there has been a shutdown in many elective surgical facilities and outpatient services (7). Arthroscopic surgeries of the knee include many different procedures including meniscal repair or resection, reconstruction of anterior cruciate ligament (LCA) or other ligaments and tendons, microfracturing for chondral damage and other procedures (8) warranted by the type of pathology of the knee. The most common are reconstruction of LCA and meniscal resection. Different types of procedures warrant for different protocols of rehabilitation. Studies suggest that physical therapy after surgery may enhance the outcome (9, 10) but they also show that at least for some pathologies, home exercise programs after arthroscopic surgery are effective (11, 12). Many studies recommend that arthroscopic surgery of the knee should be followed by a physical therapy regimen in order to regain the best functional outcome (9, 10, 13, 14).

¹Department of Physical and Rehabilitation Medicine, General Hospital Murska Sobota, Murska Sobota, Slovenia, and ²Institute of Physical and Rehabilitation Medicine, University Medical Centre Maribor, Maribor, Slovenia

Address for correspondence: Maja CIMERMAN, Department of Physical and Rehabilitation Medicine, General Hospital Murska Sobota, Ul. Dr. Vrtnjaka 6, 9000 Murska Sobota, Slovenia.
Phone: +38641658475

Tab. 1. Measurements of ROM for group 1.

Gender	Age (yr)	First ROM extension (°)	First ROM flexion (°)	Follow-up extension (°)	Follow-up flexion (°)
M	46	5	90	0	135
M	52	0	125	0	130
F	18	0	135	0	135
F	45	10	100	5	130
M	32	30	60	0	115
M	49	5	90	0	120
M	25	0	140	0	140
M	38	0	110	0	135
F	50	0	125	0	130
M	32	0	125	0	135
M	46	10	85	10	105
M	25	5	100	0	115
F	36	0	120	0	120
M	19	0	90	0	135
M	23	0	140	0	140
M	30	0	90	0	125
F	51	10	50	0	120
M	34	25	85	5	130
M	49	20	95	0	120
M	27	0	50	0	110
F	47	5	105	0	130
M	36	15	85	5	130
M	35	10	60	0	135
F	61	0	105	5	115
F	48	5	110	0	135
M	17	5	85	0	135
F	41	10	110	0	145
F	49	10	85	0	100
F	62	5	100	0	130
M	53	5	135	0	135
F	51	0	120	0	135
M	46	5	125	0	130
F	61	0	110	0	130
M	20	0	135	0	125
M	25	20	80	0	125
F	42	7	100	5	120
M	34	5	80	0	120
F	51	15	75	5	130
M	36	5	60	0	120
F	51	0	80	5	60
M	29	0	125	0	120
F	16	25	80	15	140
M	50	10	120	0	130
M	28	5	70	0	120
F	38	10	110	0	130
F	56	0	100	0	135
M	29	20	90	5	120
M	28	0	90	0	120
M	52	0	105	0	130
M	55	0	120	0	135
M	23	15	85	0	135
M	44	0	120	0	130

M – male, F – female, ROM – range of motion

Tab. 2. Measurements of ROM for group 2.

Gender	Age (yr)	First ROM extension (°)	First ROM flexion (°)	Follow-up extension (°)	Follow-up flexion (°)
F	80	10	90	10	125
M	44	5	100	0	125
M	47	15	100	10	120
F	47	15	30	5	100
M	53	0	120	0	125
M	40	0	140	0	135
M	55	5	90	0	135
F	16	20	50	0	120
F	51	0	100	0	100
M	41	5	120	0	120
M	58	0	65	0	130
M	48	0	125	0	125
M	34	5	70	0	145
F	41	10	40	0	110
M	42	0	90	0	120
M	54	10	80	5	125
M	35	10	90	0	135
M	41	0	90	0	110
F	66	50	100	0	120
F	30	20	60	0	125
M	44	0	60	0	130
F	61	5	110	0	135
M	22	5	100	0	125
M	37	10	65	0	110
M	17	0	135	0	135
M	54	10	105	3	130
M	49	0	140	0	140
F	29	0	50	0	115
M	19	0	50	5	125

M – male, F – female, ROM – range of motion

Tab. 3. Measurements of ROM for group 3.

Gender	Age (yr)	First ROM extension (°)	First ROM flexion (°)	Follow-up extension (°)	Follow-up flexion (°)
M	30	5	90	0	120
M	19	5	95	0	120
M	42	5	110	5	130
F	48	5	110	0	120
M	25	5	110	0	130
F	36	2	90	5	110
M	17	5	80	0	125
M	46	5	115	0	120
F	22	0	90	0	150
M	35	0	90	0	125
M	37	5	110	0	130
F	46	0	110	0	120
M	27	0	60	0	90
F	34	5	70	0	100
F	44	15	100	0	135
M	26	5	120	5	130
M	23	5	110	5	135
F	44	15	90	5	120
F	16	0	50	0	145
F	46	0	80	0	110
F	27	5	95	0	130
M	17	10	120	0	130
M	43	5	80	5	90
F	50	0	70	5	105

M – male, F – female, ROM – range of motion

Tab. 4. Measurements of flexion at the first and last visits in each group.

GROUP 1			GROUP 2			GROUP 3		
Before (°)	After (°)	Improvement (°)	Before (°)	After (°)	Improvement (°)	Before (°)	After (°)	Improvement (°)
90	135	45	90	125	35	90	120	30
125	130	5	100	125	25	95	120	25
135	135	0	100	120	20	110	130	20
100	130	30	30	100	70	110	120	10
60	115	55	120	125	5	110	130	20
90	120	30	140	135	-5	90	110	20
140	140	0	90	135	45	80	125	45
110	135	25	50	120	70	115	120	5
125	130	5	100	100	0	90	150	60
125	135	10	120	120	0	90	125	35
85	105	20	65	130	65	110	130	20
100	115	15	125	125	0	110	120	10
120	120	0	70	145	75	60	90	30
90	135	45	40	110	70	70	100	30
140	140	0	90	120	30	100	135	35
90	125	35	80	125	45	120	130	10
50	120	70	90	135	45	110	135	25
85	130	45	90	110	20	90	120	30
95	120	25	100	120	20	50	145	95
50	110	60	60	125	65	80	110	30
105	130	25	60	130	70	95	130	35
85	130	45	110	135	25	120	130	10
60	135	75	100	125	25	80	90	10
105	115	10	65	110	45	70	105	35
110	135	25	135	135	0			
85	135	50	105	130	25			
110	145	35	140	140	0			
85	100	15	50	115	65			
100	130	30	50	125	75			
135	135	0						
120	135	15						
125	130	5						
110	130	20						
135	125	-10						
80	125	45						
100	120	20						
80	120	40						
75	130	55						
60	120	60						
80	60	-20						
125	120	-5						
80	140	60						
120	130	10						
70	120	50						
110	130	20						
100	135	35						
90	120	30						
90	120	30						
105	130	25						
120	135	15						
85	135	50						
120	130	10						

Before – measurement of flexion before physical therapy; After – measurement of flexion after physical therapy; Improvement – difference between the two measurements

Since our services have been reduced, we wanted to analyze how this situation has affected the rehabilitation of patients after knee arthroscopy in our institution as well as to analyze how the pandemic influenced the number of patients referred to our ward.

Methods

The data were gathered retrospectively from the medical records of the IPRM at UMC Maribor. The search included all patients with ICD-10 codes S83X who were referred to our ward between January 1, 2020, and July 24, 2020. Only patients who

had undergone knee arthroscopy were selected. The patients were divided into three groups. In the first group we included patients from the period up to the declaration of the pandemic, in the second group we included patients affected by the lockdown, and in the third group we included patients from the period after the non-urgent medical activity had been gradually reestablished. We compared the number of patients that were referred to our ward and the outcome of rehabilitation based on the range of motion measurements (ROM) at the beginning and end of the physical therapy program. For the purpose of this analysis, we excluded all patients who had fewer than two measurements of ROM done on two different occasions and those who did not have physical therapy at our ward.

All procedures involving human participants in this study were in accordance with the Helsinki declaration.

Results

In our outcome of rehabilitation analysis, we included 105 patients after knee arthroscopy. In group 1 which was treated before the pandemic, there were 52 patients (19 women, 33 men) (Tab. 1) with the mean age of 39 years (SD 13, median 39.5). In group 2 which was greatly affected because of the complete lockdown, 29 patients were included (9 women, 20 men) (Tab. 2) with the mean age of 43 (SD 15, median 44). In group 3, 24 patients (11 women, 13 men) (Tab. 3) were included with the mean age of 33 (SD 11, median 34.5). Kolmogorov-Smirnov test of normality showed that all three samples were normally distributed. Two-sample Kolmogorov-Smirnov test showed that the groups 1 and 3 come from the same distribution.

Finally, we compared the improvement in ROM of flexion (Tab. 4) of the knee for our patients between groups using linear regression and ANOVA statistics (Tab. 5) and found that there are no significant differences in the improvement of ROM of flexion of the knee between groups ($p=0.246$).

In total, 132 patients after knee arthroscopy were referred to our ward (Tab. 6). Among them, 3 had the procedure done in September 2019, 7 in October 2019, 25 in November 2019, 23 in December 2019, 17 in January 2020, 24 in February 2020, and 9 in March up to March 11, 2020, i.e., up to the start of lockdown. From May 12, 2020, when the lockdown was cancelled, 9 patients

were referred in May, 14 in June, and 1 in July 2020. Between November 2019 and February 2020, 22 procedures were done on average per month in comparison to June, when only 14 procedures were done (fewer by 36 %).

Discussion

Knee arthroscopy is one of the most commonly performed arthroscopic procedures done mostly because of meniscal injuries or LCA tears, which is also true for patients sent to our ward before and after the pandemic. Meniscal injuries are treated predominantly with meniscectomy or meniscal sutures, whereas LCA tears are treated with reconstruction using a graft tendon obtained from *musculus gracilis*, *musculus semitendinosus* or patellar tendon.

Among the procedures that were executed we found ACL reconstruction, meniscectomies (partial, or complete), meniscal reconstruction, reconstruction of other ligaments, microfracturing, adhesiolysis or a combination of these procedures.

During the COVID-19 pandemic, orthopedic procedures and physical therapy treatments were greatly reduced (1, 2, 3, 4, 5, 7) In our study, we demonstrated that the number of patients after arthroscopic surgery during the pandemic was reduced by 36 % as compared with the number of patients before the pandemic started (Tab. 6). During the lockdown, no arthroscopic knee surgery was done (between March 16, 2020, and May 11, 2020). The first and second groups included patients who had arthroscopy done before the declaration of epidemic in Slovenia, therefore the number of patients in each group is significantly higher than the number of patients in the third group, which includes patients after lockdown. We divided the patients referred to our ward before the lockdown in two groups because their treatment at our institute varied greatly. We included the patients who completed their physical therapy before the lockdown in the first group whereas the patients whose treatment was in some way affected by the lockdown were placed in the second group. During the lockdown, our institute was closed, and all therapy sessions were postponed. Patients were included in physical therapy later, i.e., after we started to work again.

Paulos et al. recommend that “a rehabilitative plan is based upon consideration of the effects of disuse and immobility on musculoskeletal tissues, and knowledge of the healing requirements following injury and specific surgical procedures” (8). On the basis of this knowledge, we started to assess patients more frequently but downsized the number of sessions according to the individual need of each patient. Because of the downsizing in our ward, we started to refer patients after arthroscopy to physical therapists outside of our institution. We found out that among the patients included in this analysis, every patient was referred to physical therapy, but not all were admitted to physical therapy in our ward. Since we wanted to analyze the effectiveness of physical therapy in our

Tab. 5. ANOVA statistics.

ANOVA: Single factor						
SUMMARY						
Groups	Count	Sum	Average	Variance		
Group 1	52	1390	26.73	475.38		
Group 2	29	1030	35.52	747.04		
Group 3	24	675	28.13	366.98		
ANOVA						
Source of variation	SS	df	MS	F	p	F crit
Between groups	1494.093	2	747.05	1.42	0.246077	3.085465
Within groups	53602.1	102	525.51			
Total	55096.19	104				

Tab. 6. Dates of arthroscopic procedures.

Before pandemic		During lockdown in Slovenia		After repeal of lockdown in Slovenia	
Number	date of AS	Number	date of AS	Number	date of AS
1	10.09.2019	1	29.11.2019	1	12.05.2020
2	10.09.2019	2	5.12.2019	2	18.05.2020
3	23.09.2019	3	6.12.2019	3	21.05.2020
4	3.10.2019	4	13.12.2019	4	22.05.2020
5	8.10.2019	5	13.12.2019	5	26.05.2020
6	9.10.2019	6	16.12.2019	6	28.05.2020
7	10.10.2019	7	31.12.2019	7	28.05.2020
8	22.10.2019	8	7.01.2020	8	29.05.2020
9	24.10.2019	9	9.01.2020	9	29.05.2020
10	28.10.2019	10	10.01.2020	10	5.06.2020
11	5.11.2019	11	14.01.2020	11	10.06.2020
12	7.11.2019	12	17.01.2020	12	11.06.2020
13	7.11.2019	13	21.01.2020	13	11.06.2020
14	8.11.2019	14	21.01.2020	14	12.06.2020
15	12.11.2019	15	21.01.2020	15	15.06.2020
16	12.11.2019	16	22.01.2020	16	16.06.2020
17	12.11.2019	17	22.01.2020	17	16.06.2020
18	15.11.2019	18	23.01.2020	18	18.06.2020
19	16.11.2019	19	24.01.2020	19	18.06.2020
20	19.11.2019	20	28.01.2020	20	19.06.2020
21	20.11.2019	21	29.01.2020	21	22.06.2020
22	20.11.2019	22	31.01.2020	22	22.06.2020
23	20.11.2019	23	31.01.2020	23	23.06.2020
24	21.11.2019	24	3.02.2020	24	2.07.2020
25	22.11.2019	25	3.02.2020		
26	22.11.2019	26	4.02.2020		
27	25.11.2019	27	5.02.2020		
28	26.11.2019	28	5.02.2020		
29	27.11.2019	29	6.02.2020		
30	27.11.2019	30	6.02.2020		
31	27.11.2019	31	7.02.2020		
32	27.11.2019	32	7.02.2020		
33	28.11.2019	33	10.02.2020		
34	29.11.2019	34	13.02.2020		
35	2.12.2019	35	14.02.2020		
36	3.12.2019	36	14.02.2020		
37	3.12.2019	37	18.02.2020		
38	5.12.2019	38	18.02.2020		
39	6.12.2019	39	18.02.2020		
40	6.12.2019	40	18.02.2020		
41	11.12.2019	41	19.02.2020		
42	11.12.2019	42	19.02.2020		
43	12.12.2019	43	20.02.2020		
44	12.12.2019	44	21.02.2020		
45	13.12.2019	45	21.02.2020		
46	13.12.2019	46	26.02.2020		
47	17.12.2019	47	27.02.2020		
48	17.12.2019	48	2.03.2020		
49	20.12.2019	49	3.03.2020		
50	20.12.2019	50	3.03.2020		
51	20.12.2019	51	4.03.2020		
52	9.01.2020	52	5.03.2020		
		53	9.03.2020		
		54	10.03.2020		
		55	10.03.2020		
		56	11.03.2020		

AS – arthroscopic procedure; date format: dd/mm/yyyy

ward, for the purpose of this analysis we included only patients treated at IPRM UMC MB.

In the first and third groups, all patients were assessed for ROM and type of procedure during their first visit. Based on

these measurements, they were included in several types of physical therapy (8). In the first group, most of the patients received at least one cycle of physical therapy (at least 8 sessions), whereas in the third group, the number of sessions in a cycle was lower (at least 5). Some patients received only one up to three sessions of physical therapy based on the first measurement of ROM and improvement in pain. Patients in the second group were not assessed as systematically. Because of the lockdown, many patients did not have follow-up visits with a doctor, others were assessed only via telephone consultation, either because our ward was closed or because they did not want to enter the hospital out of fear of infection.

Østerås et al. and Dias et al suggest that any type of physical therapy after arthroscopic surgery of meniscal injuries is more effective than no physical therapy at all (9, 10). Fayard et al. demonstrated that during COVID-19 outbreak, home exercise programs had been effective after ACL reconstruction (12). With our analysis, we demonstrated that despite reducing the number of physical therapy sessions, our patients achieved good ROM results. This means that the approach we selected did not affect adversely the overall outcome for our patients.

We concluded that the outcome after knee arthroscopy had not been affected adversely by the COVID-19 pandemic in patients treated in our ward. This outcome was accomplished despite using a different approach which included in average a lower number of sessions. We found out that the overall number of patients had been reduced.

References

1. Ferahman S, Dural A, Aydin H, Sahbaz N, Akarsu C, Peker K, Donmez T, Karabulut M. Analysis of general surgery outpatient clinic admissions and operations during COVID-19 pandemic in Turkey: Reactions of 12728 patients. *Bratisl Med J* 2021; 121 (7): 475–480.
2. Escalon M, Raum G, Tieppo Francio V, Eubanks J, Verduzco-Gutierrez M. The Immediate Impact of the Coronavirus Pandemic and Resulting Adaptations in Physical Medicine and Rehabilitation Medical Education and Practice. *PM&R* 2020; 12 (10): 1015–1023.

3. **Boldrini P, Bernetti A, Fiore P.** Impact of COVID-19 outbreak on rehabilitation services and Physical and Rehabilitation Medicine physicians' activities in Italy. An official document of the Italian PRM Society (SIMFER). *Eur J Phys Rehab Med* 2020; 56 (3).
4. **Chaler J, Gil Fraguas L, Gómez García A, Laxe S, Luna Cabrera F, Llavona R et al.** Impact of Coronavirus disease 2019 outbreak on rehabilitation services and physical rehabilitation medicine and rehabilitation physicians' activities: perspectives from the Spanish experience. *Eur J Phys Rehab Med* 2020; 56 (3).
5. **Jesenšek Papež B, Šošić L, Bojnec V.** The consequences of COVID-19 outbreak on outpatient rehabilitation services: a single-center experience in Slovenia. *Eur J Phys Rehab Med* 2021; 57 (3).
6. **Demes P, Traubner P.** Coronavirus pandemic and the Slovak medical faculties. *Bratisl Med J* 2020; 121 (7): 481–483.
7. **Goyal T, Harna B, Taneja A, Maini L.** Arthroscopy and COVID-19: Impact of the pandemic on our surgical practices. *J Arthrosc Joint Surg* 2020; 7 (2): 47–53.
8. **Paulos L, Wnorowski D, Beck C.** Rehabilitation Following Knee Surgery. *Sports Med* 1991; 11 (4): 257–275.
9. **Dias J, Mazuquin B, Mostagi F, Lima T, Silva M, Resende B et al.** The Effectiveness of Postoperative Physical Therapy Treatment in Patients Who Have Undergone Arthroscopic Partial Meniscectomy: Systematic Review with metaanalysis. *J Orthop Sports Phys Ther* 2013; 43 (8): 560–576.
10. **Osteras H, Osteras B, Torstensen T.** Is postoperative exercise therapy necessary in patients with degenerative meniscus? A randomized controlled trial with one year follow-up. *Knee Surg Sports Traumatol Arthrosc* 2012; 22 (1): 200–206.
11. **St-Pierre D.** Rehabilitation Following Arthroscopic Meniscectomy. *Sports Med* 1995; 20 (5): 338–347.
12. **Fayard J, Tatar M, Thaunat M, Sonnery-Cottet B, Freychet B, Bauwens P.** Using a self-rehabilitation application alone can effectively combat post-ACL ligament reconstruction flexion contracture during the COVID-19 lockdown. *Orthop J Sports Med* 2021; 9 (Suppl 2): 2325967121S0001.
13. **Osteras.** Medical Exercise Therapy is Effective After Arthroscopic Surgery of Degenerative Meniscus of the Knee: A Randomized Controlled Trial. *J Clin Med Res* 2012.
14. **Eckenrode B.** An algorithmic approach to rehabilitation following arthroscopic surgery for arthrofibrosis of the knee. *Physiother Theory Practice* 2017; 34 (1): 66–74.

Received October 18, 2021.
Accepted November 19, 2021.