Comparative Study for Evaluation of Effectiveness of Rehabilitation in Rapid Recovery for Patients with Total Knee Arthroplasty

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Abstract

Aim: Our Rehabilitative Center joined a Surgical Center, active in the same part of Tuscany, in order to prime fast recovery model. The aim of the present study is to verify the trend of the fore mentioned ongoing project compared with the earlier rehabilitative treatment regarding patients who have undergone the same kind of total knee arthroplasty.

Design: The study is retrospective and focuses on a plurality of factors.

Setting: Surgical and rehabilitative facilities' location, patients with knee prosthesis were considered

Population: Patients with knee prosthesis (right and left) operated in elective surgery in surgical and rehabilitative facilities' location who underwent 'Standard' or "Rapid Recovery" rehabilitation for seven days, also patients that decided to stay in rehabilitation for more than seven days by their own decision.

Methods: The first hypothesis wants to prove that the clinical-rehabilitative improvements gained with Rapid Recovery, are more significant (or at least equal) than those gained with the standard treatment. It exist a positive and statistically significant correlation (Pearson's indicator) between the clinical-rehabilitative results based on the incoming and outcoming variations of the IKSS scale (considered as primary outcome measure) and the variations of other scales: we mean to demonstrate such a positive correlation. We intend to demonstrate that 7 days of rehabilitation are necessary and sufficient to achieve significant therapeutic results.

Results and conclusion: It is possible to say that improvements with a rehabilitation program are linked to improvements in everyday life ability's recovery.

The improvements that have been found in group 3 differ significantly with group 2. A hospitalization longer than 7 days appears definitely positive and patients experience a further improvement. Notwithstanding, it can be stated that a 7 days hospitalization might be sufficient to achieve a result compatible with a return home in autonomy.

Introduction

Total knee arthroplasty is a frequent operation caused by both processes of osteoarthritis and traumatic injuries. It is a kind of intervention that causes a high degree of pain to the patient and may often bring to a lengthening of the recovery. During the past few years there has been an increased demand for joint arthroplasty, which has coincided with the global economic recession [1-12]. The necessity to improve the quality and standards of recovery and rehabilitation, but also to reduce the patient's permanence in the facility, arouses. In the past, the length of hospital stay after primary total knee arthroplasty exceeded several weeks [6]. The model of "Rapid Recovery" (RR) has been developed: it was introduced in 1997 by Khelet and meant the beginning of the Fast Truck model or the Rapid Recovery. It involves a faster rehabilitation process, an earlier discharge and the improvement of each of the patient's pre, intra and post-operative phases. The key of the Rapid Recovery is the involvement of the patient by the empowerment, a preoperative patient education that make the patient able to take part of an effective post-operative physical therapy to manage their own health problems [1].

The management of patient following arthroplasty is continuously evolving with the aim of maximize efficiency, patient satisfaction and exceptional functional outcomes [12]. All patients have various experiences regarding physical therapy therefore an evidence based rehabilitation protocol might be needed [6].

We attempt to verify if our rehabilitation protocol in the early postoperative phase after rapid recovery lead to better functional results comparing to previous model.

Outcome indicators

The following parameters systematically registered at the moment of admission and discharge by the MD, the physiotherapist and healthcare assistant are used to measure the outcome of the rehabilitative treatment of the two groups of patients:

IKSS-International Knee Society Score

FIM-Functional Independent Measure

Pain scale (numerical-verbal scale from 1 to 10)

ReTos (evaluation of the risk of falling)

Method

Research hypothesis

First hypothesis: The first hypothesis wants to prove that the clinical-rehabilitative improvements gained with Rapid Recovery (group 2: g.2), are more significant (or at least equal) than those gained

with the standard treatment (group 1: g.1). The scope is to identify whether the improvements measured on the different outcome values compared with the incoming ones for each of the scales IKSS, FIM, Pain e ReTos are statistically significant.

Therefore, in formulas:

(IKSS in–IKSS out) g.2>(IKSS out–IKSS in) g.1 con $p \leq 0.05$

(FIM out–FIM in) g.2>(FIM out–FIM in) g.1 con $p \leq 0.05$

(Pain in–Pain out) g.2>(Pain in–Pain out) g.1 con $p \leq 0.05$

(ReTos in–ReTos out) g.2>(ReTos in–ReTos out) g.1 con $p \leq 0.05$

The hypothesis for the comparison test between the two groups is the following:

H0=The observed differences come from patients belonging to the same population (thus depending on coincidence): the two population from which the samples are taken have thus the same median.

H1=The observed differences are statistically significant (with a probability of 0.05): the median of the sample 2 is thus greater than that of sample 1.

Second hypothesis: It exist a positive and statistically significant correlation (Pearson's indicator) between the clinical-rehabilitative results based on the incoming and outcoming variations of the IKSS scale (considered as primary outcome measure) and the variations of other scales.

We mean to demonstrate such a positive correlation for the following couples of results, considering as sample both the two groups separately (sample=g.1 or g.2) and the sum of the two groups (sample=g.1 and g.2):

IKSS positively correlates with Pain

IKSS positively correlates with ReTos

IKSS positively correlates with FIM

A third group of patients has been taken into account: those patients who at the end of the seven-days recovery period chose to lengthen it. Patients stay on average one more week privately in order to achieve a higher level of independence and thus a safe way home.

Third hypothesis: We intend to demonstrate that 7 days of rehabilitation are necessary and sufficient to achieve significant therapeutic results. The group of patients recovered in 2015 in RR for seven days has been thus compared with the group of patient recovered in the same facility for more than seven days.

(group 2: g.2 with occupant days ≤ 7; gruop 3: gr.3 with occupant days>7).

(IKSS out–IKSS in) g.2=(IKSS out–IKSS in) g.3 with $p \leq 0.05$

(FIM out–FIM in) g.2=(FIM out–FIM in) g.3 with $p \leq 0.05$

(Dolore in–Dolore out) g.2=(Dolore in–Dolore out) g.3 with $p \leq 0.05$

(ReTos in–ReTos out) g.2=(ReTos in–ReTos out) g.3 with $p \leq 0.05$

H0=The observed differences are statistically significant (with a probability of 0.05): the median of the sample 2 is different from that of sample 3.

H1=The observed differences come from patients belonging to the same population (thus depending on coincidence): the two population from which the samples are taken have thus the same median.

Sample's Characteristics

General characteristics

Two groups of patients have been taken into account: Group 1: patients with knee prosthesis (right and left) operated in elective surgery at Centro Chirurgico Toscano (Via dei lecci 22, Arezzo) from 01/01/2014 to 31/12/2014 who underwent 'Standard' rehabilitation at Centro di Riabilitazione Ortopedica e Neurologica Arìa (Loc. Agazzi 47, Arezzo);

Group 2: patients with knee prosthesis (right and left) operated in elective surgery at Centro Chirurgico Toscano (Via dei lecci 22, Arezzo) from 01/01/2015 to 31/12/2015 who underwent "Rapid Recovery" rehabilitation for seven days at Centro di Riabilitazione Ortopedica Arìa, in the facility of Centro Chirurgico Toscano itself; A third group of patient have been considered as there were many patients that decided to stay in rehabilitation for more than seven days by their own decision. So this group was used to analyze the third hypothesis of this study.

Group 3: patients with knee prosthesis (right and left) operated in elective surgery at Centro Chirurgico Toscano (Via dei lecci 22, Arezzo) from 01/01/2015 to 31/12/2015 who underwent "Rapid Recovery" rehabilitation for more than seven days at Centro di Riabilitazione Ortopedica Arìa, in the facility of Centro Chirurgico Toscano itself; Surgical and rehabilitative facilities' location

Group 1: Surgical facility: Centro Chirurgico Toscano (CCT): Via dei lecci 22 Arezzo (AR)

Rehabilitative facility: Centro di Riabilitazione Ortopedica e Neurologica Arìa: Località Agazzi 47 Arezzo (AR)

Group 2 and 3: Surgical facility: Centro Chirurgico Toscano (CCT): Via dei lecci 22 Arezzo (AR)

Rehabilitative facility: Centro Chirurgico Toscano (CCT): Via dei lecci 22 Arezzo (AR)

Qualitative and quantitative features of samples 1, 2 and 3 started in 2015 our Rehabilitative Center joined a Surgical Center in order to prime fast recovery model. We experimented a new setting of rehabilitation: smaller ward and specialized to treat patient in the early postoperative phase after rapid recovery for total knee arthroplasty. Every worker is highly specialized in rehabilitation of this kind of patient, the facility is designed to make easy and safe patient transfer by crutches or rollator, patients has the opportunity to call an orthopaedic consultant for questions regarding pain, wound care etc., pain medication and rehabilitation protocol are standardized.

Informations are given on complication that may be encountered in the postoperative period such as pain and problematic movements and activities. Patients were informed about the protocol and signed informed consent.

The population of patients who undergo elective surgical operation is highly selected already. Besides, the cases of intra and post-operative complications are considered relevant, making the sample more representative. For these reasons, inclusion and exclusion criteria have not been applied to patients in the three groups.

We have 88 patients in group 1 (36 men and 52 women, average age 74.2) who undergo surgical operation at CCT and transfer to another rehabilitative facility. The rehabilitation ward has 32 beds both for orthopedic and neurological pathologies. They have physiatrist, healthcare assistant, physiotherapists and healthcare professional. Every patient has his own rehabilitation protocol. The standard duration of

patient stay in rehabilitation ward is ≥ 5 days with between 5 and 8 days after surgery before entrance.

In group 2 we have 77 patients (29 men and 48 women, average age 71.1) who undergo surgical operation and rehabilitation protocol in the same facility at CCT. The rehabilitation ward has 10 beds only for patient with elective surgical operation of hip replacement and knee prosthesis. Patients have physiatrist, healthcare assistant, healthcare professional and physiotherapists. They have personal rehabilitation protocol and the average duration of stay is 7 days with 5 days after surgery before entrance. Group 3 has 41 patients (16 men and 25 women, average age 71.6) and it differs from group 2 only because the duration of patient stay is more than 7 days.

We examined patients the first day of recovery in rehabilitation ward and at the moment of discharge. Usually the patient can continue the rehabilitation protocol as outpatient in ambulatory if he wants and if needed (Table 1).

The qualitative features of the rehabilitative and clinical treatments of the three groups (Table 2)

Quantitative features of the three groups (Table 3)

Comorbidity in patients of group 1, 2, 3

Results

Descriptive statistics

The descriptive statistic values of the four evaluation scale's

Feature	Group 1	Groups 2 and 3
Percorso	Surgical operation at CC and transfer to rehabilitative facility by ambulance or other means of transportation.	One facility for both operation and rehabilitation.
Rehabilitation context	Rehabilitation ward with 32 beds for residential patients and 22 for outpatients with an outcome of orthopedic and neurological pathologies	Rehabilitation ward with 10 residential beds for patients with elective surgical operation of hip replacement and knee prosthesis.
Operators	Physiatrist healthcare assistant, healthcare professional, speech therapists and physiotherapists for all patients' pathologies e typologies.	Physiatrist, healthcare assistant, healthcare professional and physiotherapists.
Rehabilitation protocol	Individual PRI. 3 rehabilitation hours in the gym in the morning and 2 h in the afternoon; Individual treatment: manual mobilization of the knee, reeducation to walking and climbing stairs; Group treatment: strengthening, stretching, passive knee mobilization.	Individual PRI. 3 rehabilitation hour in the morning and in the afternoon 3 of which in the gym with the physiotherapist and 3 in the room doing exercises under OSS and/or healthcare assistant supervision; exercises guided by physiotherapist; Individual treatment: manual knee mobilization. reeducation (walking and climbing stairs); Group treatment: strengthening, stretching, passive knee mobilization.
Equipment	Virtual reality Riablo, motomed, minivector, tapis roulant, proprioceptive platform.	Virtual reality, motomed, Minivector, virtual reality "Riablo".
Clinical care	Medications done by nurses and doctors; laboratory tests as well as diagnostic investigations; outsourced specialists's examination	Medications done by nurses and doctors; check by in house surgeons in case of complications.
Days of standard rehabilitation	≥ 5 days	≤ 7 days
Days after surgery before entrance	between 5 and 8 days	5 days

Table 1: The qualitative features of the rehabilitative and clinical treatments of the three groups.

Feature	Group 1	Group 2	Group 3
Number	88	77	41
Right knee prosthesis	55 (62.5%)	42 (54.5%)	22 (53.7%)
Left knee prosthesis	33 (37.5%)	35 (45.5%)	19 (46.3%)
Men	36 (41%)	29 (37.7%)	16 (39.0%)
Women	52 (59%)	48 (62.3%)	25 (61.0%)
Average age	74.2	71.1	71.6
Average convalescence days	8.25	6.99	10.71

Table 2: Quantitative features of the three groups.

Comorbidity (afflicted pcs ≥ 10)	Group 1	Comorbidity(afflicted pcs ≥ 10)	Group 2	Comorbidity (afflicted pcs ≥ 10)	Group 3
Hypertension	53	Hypertension	50	Hypertension	25
Dyslipidaemia	1	Dyslipidaemia	16	Hypercholesterolaemia	5
Diabetes	6	Diabetes	8	Diabetes	5
Diverticulitis	6	Diverticulitis	6	Diverticulitis	3
Hypothyroidism	5	Hiatus hernia	6	Hypothyroidism	3
Hypercholesterolaemia	5	Hypothyroidism	6	Hypoacusis	2
Dist. ansioso-depress.	7	Hyperuricaemia	5	Incisional hernia	2
Hiatus hernia	4	Tenolyisis	5	Dist. depressivo	2
Hypertensive cardiopathy	4	Osteoporosis	4	Prostatic hypertrophy	2
BPCO	6	Prostatic hypertrophy	4	Venous insuff.	2
Hyperuricaemia	4	Hypertensive cardiopathy	4	Dyslipidaemia	2

Table 3: Comorbidity in patients of group 1, 2, 3.

variations of the three groups (see also Appendix) are reported in tables 4-7.

IKSS OUT-IN variations of group 1, 2, 3

FIM OUT-IN variation of group 1, 2, 3

PAIN IN-OUT variation of group 1, 2, 3

RETOS IN-OUT variation in group 1, 2, 3

Normality check

Shapiro-Wilk's test (Table 8) has shown that distributions of IN-OUT differences (IKSS e FIM) and OUT-IN differences (pain and reTos) are not all normally distributed (statistical significance>0,05), with the exception of the differences marked yellow below. Same results can be derived also from asymmetry and kurtosis values. Consequently, it has been necessary to use non parametrical tests for the inferential statistics) (Table 8).

Shapiro-Wilk's test

First hypothesis check

Being the distribution not normal, it was used the Mann Whiteny U-test T0 and T1 between groups with p=0.05 (Table 9) and the Wilcoxon W-test T0 and T1 within same group with p=0.05 (Tables 10 and 11) in order to verify how the values are disposed around the meridian (Figures 1 and 2).

Group				Statistics
IKSS OUT-IN	1	Average		24.00
		95% of the confidence interval for the average	Lower limit	22.28
			Upper limit	25.72
		Cut average at 5%		24.42
		Median		25.00
		Variance		66.207
		Std. deviation		8.137
		Minimum		2
		Maximum		38
		Range		36
	2	Average		27.47
		95% of the confidence interval for the average	Lower limit	26.29
			Upper limit	28.65
		Cut average at 5%		27.39
		Median		28.00
		Variance		27.068
		Std. deviation		5.203
		Minimum		12
		Maximum		49
		Range		37
	3	Average		26.56
		95% of the confidence interval for the average	Lower limit	24.38
			Upper limit	28.74
		Cut average at 5%		26.59
		Median		26.00
		Variance		47.702
		Std. deviation		6.907
		Minimum		9
		Maximum		44
		Range		35

Table 4: IKSS OUT-IN variations of group 1, 2, 3.

Group				Statistics
FIM OUT-IN	1	Average		13.09
		95% of the confidence interval for the average	Lower limit	11.67
			Upper limit	14.51
		Cut average at 5%		12.91
		Median		14.00
		Variance		44.842
		Std. deviation		6.696
		Minimum		0
		Maximum		31
		Range		31
	2	Average		12.31
		95% of the confidence interval for the average	Lower limit	10.92
			Upper limit	13.70
		Cut average at 5%		11.83
		Median		11.00
		Variance		37.428
		Std. deviation		6.118
		Minimum		3
		Maximum		31
		Range		28
	3	Average		15.10
		95% of the confidence interval for the average	Lower limit	12.67
			Upper limit	17.52
		Cut average at 5%		14.19
		Median		13.00
		Variace		59.040
		Std. deviation		7.684
		Minimum		4
		Maximum		42
		Range		38

Table 5: FIM OUT-IN variation of group 1, 2, 3.

Distributions of IN – OUT differences (IKSS and FIM) by Shapiro–Wilks test and OUT –IN differences (pain and ReTos) are not all normally distributed (Table 9).

Statistics U-test Mann Whiteny (Grouping variables: Group 1 e 2)

The asymptotic significance is <0.05 only for scale IKSS which shows a symmetrical distribution around the meridian. For other distributions it is accepted the null hypothesis, that is IN-OUT values distribution are not symmetric compared with meridian. This brings to state that the comparison between differences of scales is significant only for scale IKSS (Table 10).

Statistics W-test Wilkoxon (Group 1) (Table 11)

Statistics W-test Wilkoxon (Group 2)

The asymptotic significance is <0.05 for all scales: the null hypothesis is accepted, that is the distribution of IN and OUT values around the meridian are not symmetrical.

Second hypothesis check

The analysis of correlation (Pearson index) of primary outcome measure IKSS with other variables drove to following results. The choice was to check the correlation between the two ends of distribution as there is no ex ante knowledge of the mutual impact among variables. Results of study of each group and of the total are shown in tables 12-14.

Correlations (Group 1)

Group				Statistics
Pain IN-OUT	**1**	Average		1.40
		95% of the confidence interval for the average	Lower limit	1.17
			Upper limit	1.63
		Cut average at 5%		1.35
		Median		1.00
		Variance		1.162
		Std. deviation		1.078
		Minimum		-1
		Maximum		4
		Range		5

Group				Statistics
Pain IN-OUT	**2**	Average		1.44
		95% of the confidence interval for the average	Lower limit	0.88
			Upper limit	2.01
		Cut average at 5%		1.42
		Median		1.00
		Variance		6.171
		Std. deviation		2.484
		Minimum		-4
		Maximum		7
		Range		11
	3	Average		1.29
		95% of the confidence interval for the average	Lower limit	0.63
			Upper limit	1.96
		Cut average at 5%		1.27
		Median		1.00
		Variance		4.462
		Std. deviance		2.112
		Minimum		-3
		Maximum		6
		Range		9

Table 6: PAIN IN-OUT variation of group 1, 2, 3.

Group				Statistics
ReTos IN-OUT	**1**	Average		1.83
		95% of the confidence interval for the average	Lower limit	1.33
			Upper limit	2.33
		Cut average at 5%		1.66
		Median		0.00
		Variance		5.591
		Std. deviation		2.365
		Minimum		-3
		Maximum		12
		Range		15
	2	Average		2.03
		95% of the confidence interval for the average	Lower limit	1.54
			Upper limit	2.51
		Cut average at 5%		1.93
		Median		3.00
		Variance		4.631
		Std. deviation		2.152
		Minimum		-1
		Maximum		6
		Range		7

Group				Statistics
ReTos IN-OUT	**3**	Average		1.59
		95% of the confidence interval for the average	Lower limit	0.92
			Upper limit	2.25
		Cut average at 5%		1.48
		Median		0.00
		Variance		4.449
		Std. deviation		2.109
		Minimum		-2
		Maximum		6
		Range		8

Table 7: RETOS IN-OUT variation in group 1, 2, 3.

Correlations (Group 2)

Correlations (Group 1+2)

Correlations statistically significant ($p < 0.05$, marked yellow) are those between the IKSS scale and the FIM scale in each group and in the two groups together. Correlations (marked green) are all positive and quite weak.

Third hypothesis test

As for the check of the first one, also in the third hypothesis has been used the significancy Mann Whiteny U-test T0 and T1 between groups with $p = 0,05$ (Table 15) and the Wilcoxon W-test T0 and T1 within same group with $p = 0,05$ (Tables 16 and 17) in order to verify how the values are disposed around the meridian (Table 15).

Statistics U-test Mann Whiteny (Grouping variables: Groups 2 and 3)

The asymptotic significance is < 0.05 only for FIM scale which has a symmetrical distribution around the meridian. For the other distributions it is accepted the null hypothesis, that is the values distributions in and out are not symmetric compared with meridian.

This brings to state that the comparison between differences of scales is significant only for scale FIM (Table 16).

Statistics W-test Wilkoxon (Group 2) (Table 17).

Statistics W-test Wilkoxon (Group 3)

Group		**Shapiro-Wilk**		
		Statistics	d.o.f	Significance
IKSS OUT-IN	1	0.936	88	0.000
	2	0.937	77	0.001
	3	0.958	41	0.136
FIM OUT-IN	1	0.978	88	0.146
	2	0.895	77	0.000
	3	0.793	41	0.000
Pain IN-OUT	1	0.908	88	0.000
	2	0.972	77	0.091
	3	0.943	41	0.039
ReTos IN-OUT	1	0.806	88	0.000
	2	0.792	77	0.000
	3	0.788	41	0.000

Table 8: Shapiro–Wilk's test.

Statistics U-test Mann Whiteny (Grouping variables: Group 1 e 2)				
	IKSS OUT-IN	FIM OUT-IN	PainIN-OUT	ReTosIN-OUT
Mann-Whitney's U	2652.500	3107.500	3342.000	3169.000
Asympt. Sign. (two sided)	0.016	0.359	0.878	0.441

Table 9: Statistics U-test Mann Whiteny (Gruping variables: Group 1 e 2).

Statistics W-test Wilkoxon (Group 1)

	IKSS OUT-IKSS IN	FIM OUT-FIM IN	Pain OUT - Pain IN	ReTos OUT-ReTos IN
Z	-8.148[b]	-8.059[b]	-7.317[c]	-5.670[c]
Asympt. Sign. (two sided)	0.000	0.000	0.000	0.000
b. Based on negative ranks.				
c. Based on positive ranks.				

Table 10: Statistics W-test Wilkoxon (Group 1).

Statistics W-test Wilkoxon (Group 2)

	IKSS OUT-IKSS IN	FIM OUT-FIM IN	Pain OUT-Pain IN	ReTos OUT-ReTos IN
Z	-7.632[b]	-7.630[b]	-4.446[c]	-5.955[c]
Asimpt. Sign. (two sided)	0.000	0.000	0.000	0.000
b. Based on negative ranks				
c. Based on positive ranks				

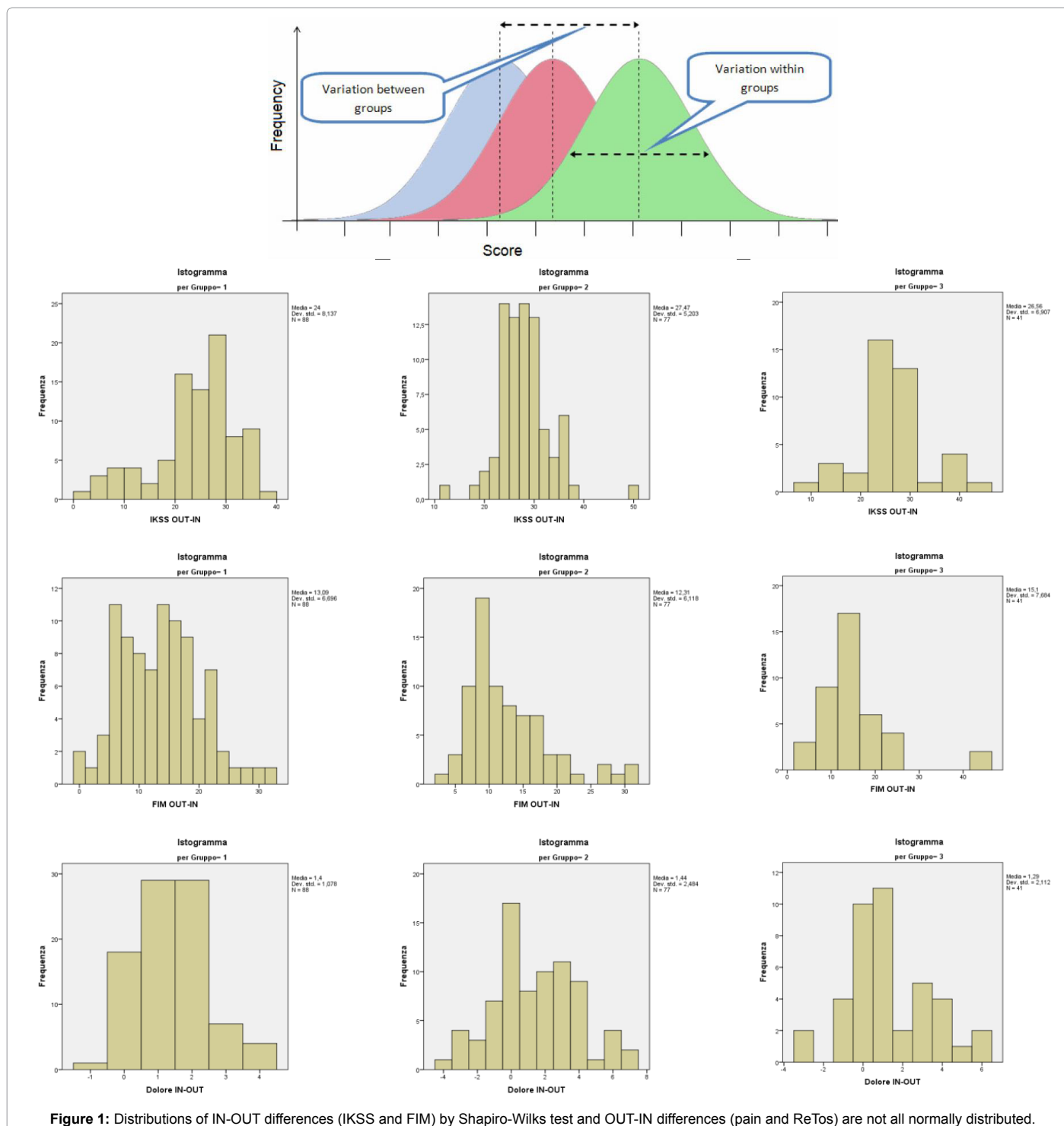**Table 11:** Statistics W-test Wilkoxon (Group 2).

Figure 1: Distributions of IN-OUT differences (IKSS and FIM) by Shapiro-Wilks test and OUT-IN differences (pain and ReTos) are not all normally distributed.
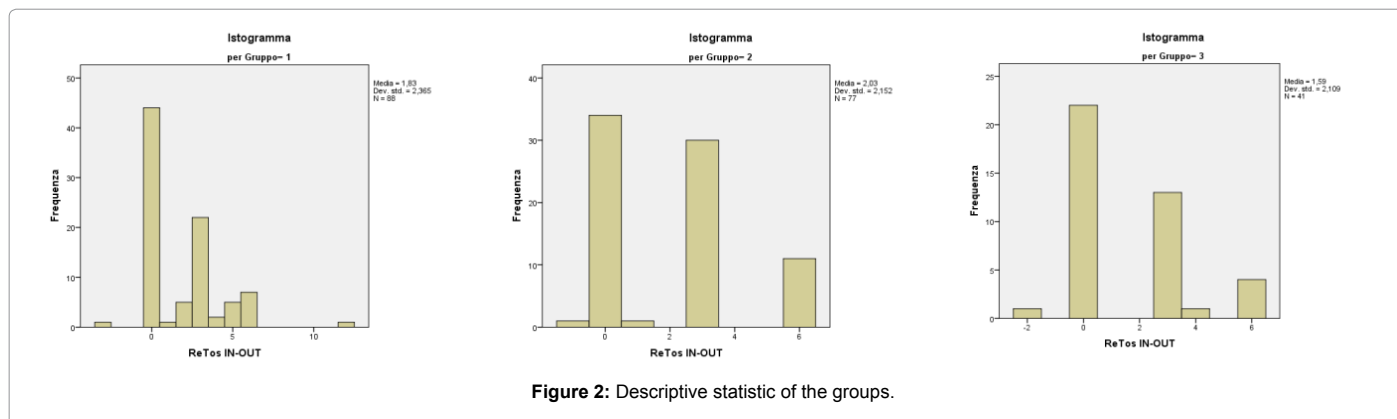
Figure 2: Descriptive statistic of the groups.

Correlations (Group 1)				
		FIM OUT-IN	Pain IN-OUT	ReTos IN-OUT
IKSS	Pearson correlation	0.317	0.201	0.010
OUT-IN	Sign. (two sided)	0.003	0.060	0.927
	N	88	88	88

Table 12: Correlations (Group 1).

Correlations (Group 2)				
		FIM OUT-IN	Pain IN-OUT	ReTos IN-OUT
IKSS	Pearson correlation	0.368	0.125	-0.161
OUT-IN	Sign. (two sided)	0.003	0.277	0.162
	N	88	88	88

Table 13: Correlations (Group 2).

Correlations (Group 1+2)				
		FIM OUT-IN	Pain IN-OUT	ReTos IN-OUT
IKSS	Pearson correlation	0.304	0.130	-0.035
OUT-IN	Sign. (two sided)	0.000	0.096	0.656
	N	165	165	165

Table 14: Correlations (Group 1+2).

Statistics U-test Mann Whiteny (Grouping variables: Groups 2 and 3)				
	IKSS OUT-IN	FIM OUT-IN	Pain IN-OUT	ReTos IN-OUT
U di Mann-Whitney	14.20.500	11.30.500	15.29.000	14.11.000
Asympt. Sign. (two sided)	0.369	0.011	0.777	0.302

Table 15: Statistics U-test Mann Whiteny (Grouping variables: Groups 2 and 3).

Statistics W-test Wilkoxon (Group 2)				
	IKSS OUT-IKSS IN	FIM OUT-FIM IN	Pain OUT-Pain IN	ReTos OUT-ReTos IN
Z	-7.632[b]	-7.630[b]	-4.446[c]	-5.955[c]
Asimpt. Sign. (two sided)	0.000	0.000	0.000	0.000
b. Based on negative ranks				
c. Based on positive ranks				

Table 16: Statistics W-test Wilkoxon (Group 2).

The asymptotic significance is <0.05 for all scales: the null hypothesis is accepted, that is the distribution of IN and OUT values around the meridian are not symmetrical.

Statistics W-test Wilkoxon (Group 3)				
	IKSS OUT-IKSS IN	FIM OUT-FIM IN	Pain OUT-Pain IN	ReTos OUT-ReTos IN
Z	-5.584[b]	-5.584[b]	-3.462[c]	-3.935[c]
Asimpt. Sign. (two sided)	0.000	0.000	0.001	0.000
b. Based on negative ranks.				
c. Based on positive ranks.				

Table 17: Statistics W-test Wilkoxon (Group 3).

Discussion

The principal finding of this study is that the application of a rapid recovery protocol in patient undergoing total knee arthroplasty combined with high quality healthcare services increased patient satisfaction and improved functional results. Beside there is an efficient and productive use of limited resources. The rehabilitation program has to be effective, rapid and personalized.

Our results are in agreement with other studies [2,4,9,12]

The analysis of the sample points out homogeneous population in the two groups with reference to gender and mean age (with a slightly senior age in group 1). The average number of occupant days matches the criteria for the partitions of the three groups: 7 days for group 2, more than 7 days for group 3 and a medium value for group 1.

Comorbidities turn out to be distributed homogeneously through the three groups. The typology of the more significant is not found to have clinic relevance significant as far as the rehabilitation purposes under study are concerned.

The verification of the quantitative characteristic of samples allows us to state with enough accuracy that the two groups show profile similar and comparable.

Distributions of variations of the four scales utilized for the evaluation of the therapeutically results are found out not normal (Shapiro-Wilk's test) with following exceptions:

Distribution IKSS OUT-IN in group 3;

Distribution FIM OUT-IN in group 1;

Distribution PAIN IN-OUT in group 2.

For verification of the first hypothesis it was necessary to utilize methods non parametric of statistical significance, specifically the U-test di Mann-Whitney (between tra T_0 e T_1) and the Wilkoxon's test (within tra T_0 e T_1).

Both tests have shown significant differences for scale IKSS (asymptotic significance between=0.016).

It is possible to say that improvements (3 points difference in the median of groups 1 and 2) that have been found in group 2 (experimental program in rapid recovery) through the measure of scales IKSS values differences (administered IN and OUT of the rehabilitation program) differ significantly with group 1 (standard program).

Other scales have not shown relevant evidences. It can be assumed that this is due to several factors:

High impact of motivational, social and psychological (not included in the analysis) variables in patient's recovery of everyday life's autonomy (with reference to the evaluation done with the FIM scale).

Poor sensitivity of the scales for PAIN measurement (scale numeric-verbal 1-10) and for risk of falling (ReTos) due to:

Patient's subjectivity and variation of conditions at the moment of evaluation of PAIN measurement;

Shortness of rehabilitation program that does not allow appreciating significant differences in respect to the evaluation of Risk of falling and to the exploitation of clinical aspects not immediately linked to the rehabilitation program (pharmacological therapy, other pathologies, etc.)

For verification of second hypothesis it's been utilized the Pearson index. It was found out a statistically significant correlation (=0.03) between scale IKSS and scale FIM in sample of group 1 and 1+2. Positive correlation shows that the best results reachable with a rehabilitation program are linked to improvements in everyday life ability's recovery.

For verification of the third hypothesis it was necessary to utilize methods non parametric of statistical significance, specifically the U-test di Mann-Whitney (between tra T0 e T1) and the Wilkoxon's test (within tra T0 e T1).

Tests has shown relevant differences for scale FIM (asymptotic significance between=0.011).

It is possible to say that improvements (2 points difference in the median of groups 2 and 3) that have been found in group 3 (experimental program in rapid recovery with more than 7 days stay) through the measure of scales FIM values differences (administered IN and OUT of the rehabilitation program) differ significantly with group 2 (experimental program in rapid recovery with up to 7 days stay).

Other scales utilized did not show any statistical relevance and therefore the null hypothesis cannot be rejected.

Such a result can lead to following considerations

Rehabilitation of everyday life activities brings to better therapeutic results if the period is longer;

Absence of statistical significance with respect to the variations of IN and OUT values of the scales IKSS, Pain and Risk of falling might be due to:

Different rate of progress of therapeutic results after the 7th day of rehabilitation for IKSS scale;

Poor sensitivity of the scales to Pain and Risk of falling compared with the hypothesis.

Given the above considerations, the hypothesis is that scales IKSS and FIM can better than other scales identify the relevance of therapeutically results achievable with the rehabilitation program.

A hospitalization longer than 7 days appears definitely positive and patients experience a further improvement. Notwithstanding, it can be stated that a 7 days hospitalization might be sufficient to achieve a result compatible with a return home in autonomy.

In addition, after release patients are involved in a outpatient procedure that allows them to refine the abilities already achieved and complete the rehabilitation program.

The choice of a longer stay follows a demand of more safety and it is doable beyond the approved program because it is a private accredited healthcare facility.

There are two major limitations of our study: limited number of patients and retrospective design.

Other limits of this research project and perspective of future insights are to be referred to the analysis of further performance indicator of the rehabilitation intervention (evaluation scales, evaluation result survey given to patients, etc.) and also to the control and verification of the impact of disturbing variables on the statistical results (comorbidity, medical surgeon who performed the surgery, etc.)

Conclusions

Functional outcomes after a rehabilitation program in rapid recovery is better than in traditional patient duration stay. Patients are satisfied by the earlier ambulation and better overall quality of recovery. It is potentially reduced the perioperative morbidity. Costs for National Healthcare System are reduced.

Some patients prefer to stay longer at the rehabilitation facility because of doubts managing their selves in their home situation and if they stay, they pay for it and it is not a cost for National Healthcare System: interesting that functional outcomes in this case are better than in the rapid recovery program.

It is commonly accepted anyway the needs to avoid a delayed discharge from hospital and evidence based and standardized rapid recovery pathways are recommended.

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