

Changes in gait kinematic parameters after rehabilitation in total knee arthroplasty subjects: A prospective observational pilot study

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Introduction: Total knee arthroplasty (TKA), is a routine surgical intervention, with an incidence of 150-200 surgeries every 100.000 people [1]. After this surgery is common practice for every subject to undergo a period of rehabilitation to recover strength, range of motion and walking ability of the affected limb. Many evaluation scales have been developed to evaluate improvements during and after rehabilitation, but the walking ability has rarely been evaluated in the acute phase[2] (3-30 days post surgery) through an optoelectronic system.

Research Question: Evaluate the effect of rehabilitation on functional outcomes scales and gait kinematic parameters and verify which parameters are clinically relevant.

Methods: After receiving Ethical approval, in a postacute rehabilitation hospital, subjects were recruited after receiving TKA; inclusion criteria were stable clinical conditions, and no other neurological or rheumatic pathologies or previous surgeries at the lower limbs. International knee society score (IKSS), Barthel Index (BI), Numerical Rating Scale (NRS), Knee Flexion (KF), and gait analysis (GA) were assessed at hospitalization (T0) and discharge (T1). The GA system is a BTS DX-400 with 8 optoelectronic cameras and 2 force platforms, the markerization protocol used was Davis-Heel (22 markers). Gait was allowed with one or two crutches according to needs, and at least 3 walks were performed.

Results: 10 subjects (age of 68.5 ± 10.7 , 5 females, 6 left knee) met the inclusion criteria. The subjects showed a significant difference between T0 and T1 in all the functional evaluation scales ($P < 0.001$) excluding NRS ($P > 0.05$). GA parameters showed a Δ of improvement of 0.06 m/s, 0.08 m, 6.64%, 3.59% respectively for gait speed, step length, single support phase and swing phase on the operated limb between T0 and T1, the comparison of Δ didn't demonstrate a significance up to now ($P = 0.07$), while a clinical effect size has been shown by IKSS, BI and KF and many of the gait kinematic parameters (Cohen's $d > 0.8$) (Table1).

Discussion: According to this study, rehabilitation improved the scores collected by the functional outcome scales [3]; gait speed, step length, single support phase and swing phase on the operated limb showed an improvement but with a lack of significance, probably due to the low sample size: the study is still ongoing and we expect that a larger sample size will produce a statistical significance. Most of the parameters detected with GA and all the functional outcomes scale showed a clinically significant effect size. Rehabilitation seems to be effective in restoring the functional competence of the subjects and GA is allow to evaluate the quality of gait during an inpatients rehabilitation period immediately after surgery.

References

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Table 1. Comparison between T0 and T1 for Functional Outcomes Scale and Gait Kinematic Parameters

Functional Outcomes Scales	pValue	Cohen's d
International knee society score (IKSS)	<0.001	5.9
Barthel Index (BI)	<0.001	3.0
Knee Flexion (KF)	<0.001	3.7
Numerical Rating Scale (NRS)	0.34	0.3
Gait Kinematic parameters		
Gait Speed	0.05	1.4
Step Length	0.06	0.7
Single Support Phase on Operated Limb	0.07	1.0
Swing Phase on Operated Limb	0.05	0.5