

## Protocol-based Rehabilitation Versus Problem Based Rehabilitation in ACL Reconstruction – Cross over Study with Evidence

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### **Abstract:**

*Adhering to standard protocols following surgeries are routinely practiced, whereas patient-specific therapy can facilitate earlier restoration of function in a quicker time frame. An increasing ACL – reconstruction surgeries are globally done. Aims & Objectives of this original cross over research was to compare protocol based exercises versus patient-centric exercises in a subject post ACL – reconstructive surgery. This original study where 40-year-old Male having undergone ACL – reconstruction (ACL – R) at Coimbatore where (Phase – I) 8 weeks of post-operative protocol based physiotherapy was carried from 13.12.2017 to 10.02.2018. Next 8 weeks (Phase – II) the same subject was treated with evaluation and patients problem-based exercises from 16.02.2018 to 17.04.2018 in Chennai. Results of Phase - I and Phase – II were analyzed statistically and discussed with evidence. With results showing  $P < .05$  for Phase – I and  $P < .001$  for Phase II. Conclusion: Apart from protocol, subjects individual evaluation and functional needs to be given priority for early an effective and enhanced rehabilitation.*

**Keywords:** ST- Semitendinosus, ACL- R Reconstruction, ROM- Range of Motion, ACL – Anterior Cruciate Ligament, AAOS – American Association of Ortho Surgery

### **Introduction:**

Anterior Cruciate ligament (ACL) is the anterior stabilizer of knee restricting anterior tibial translation and rotational forces at the tibiofemoral joint (Voss et al 2008). 80% of all knee ligament injuries were ACL injury in Newzeland (Chapman et al 2001), and ACL is the most common injuries of the knee joint and accounts for 50% of the total injuries occurring in the knee (Joseph et al 2013) and nearly 50% ACL injured subjects undergoes ACL – Reconstruction (AAOS 2007)

ACL – R is aimed at restoring joint stability, minimizing further damage to the menisci and articular cartilage (Lyunch et al 2013). With an increasing health care cost, increased psychological distress and reinjuring are recorded in a systematic review post ACL by (Wright et al 2012), this original research was needed with customized physiotherapy with problem specific evidenced means and looked beyond the protocol of what best can be done to post ACL- R rehabilitation to maximize subjects benefit and improve QOL.

**Aims & Objectives** of this cross over research were to analyse protocol based exercises versus patient-specific exercises with evidence in post ACL – R.

### **Background Information:**

40-year-old man while playing football had injured left ACL in December 2017, with a complete ACL tear and Hemarthrosis he was treated with ST graft in Coimbatore using arthroscopic procedure for ACL – reconstruction of knee. He was subsequently treated with physiotherapy inline with protocol elsewhere from 13.12.2017 (Next day of surgery) till 10.02.2018, 8 weeks after surgery.

### **O/e**

His physical condition as on 16.02.2018

Ambulant with an antalgic gait

Pain at ambulation and with movements of the knee

Left Active knee ROM  $0^{\circ}$  -  $60^{\circ}$  in the prone position

### Phase – I

This study subject was treated from 1<sup>st</sup> postoperative day on 13.12.2017 at Coimbatore till 10.02.2018 based on ACL protocol.

### Phase – II

This research was conducted at Chennai during the period from 16.02.2018 to 17.04.2018, where the subject's major problems as identified below were treated:

Clinical, functional problems identified as on 16.02.2018

1. Restricted active range of motion left of the knee at 10<sup>0</sup>-60<sup>0</sup>
2. wasting of quadriceps by 7 cm
3. pain increasing in walking and other dynamic daily activities
4. antalgic gait
5. Wasting of quadriceps was recorded, mild pre patellar effusion

With an exercise intensity gradually increased from 50% to 80% of his maximal heart rate

**Aims & Objectives** of this research analysis was to evaluate protocol based rehabilitation versus patient-specific rehabilitation on a subject with ACL reconstruction.

### Materials & Methodology:

From 16.02.2018 till 17.04.2018, he was treated with dynamic exercises using, Proprioceptive, PNF, core strengthening, quadriceps strengthening, results were compared with protocol-based exercises. This study was carried in Chennai by the author with a weekly frequency of two and each session lasting for 30-35 minutes

- I. Dynamic exercises which include resisted exercises in standing and high sitting
- II. Proprioceptive exercises using physioball, wobble board in supine, sitting and standing
- III. Core strengthening exercises were used
- IV. PNF techniques to improve range of motion and to increase the strength of quadriceps

The number of sets, repetition, and duration of exercises was gradually progressed. With a frequency of twice a week lasting for 30 – 35 minutes of each session

**The clinical prognosis** of the subject from 1<sup>st</sup> post OP till 8<sup>th</sup> weeks of ACL reconstruction surgery, where the subject was treated as per structured protocol for exercises, ambulation and knee brace. At the end of 8<sup>th</sup> week he was ambulant with antalgic gait, with a range of active knee flexion from 0<sup>0</sup>-60<sup>0</sup>, low level of confidence pain while walking and other activities.

The same subjects problems were evaluated, and specific exercises were used for next 8 weeks of twice a week frequency with methodology as stated above on table 1 the subject was able to flex the knee up to 110, floor level activities, ambulant easily, started all social, family and functional activities with an increased level of confidence and with ease.

Cadence has increased from 60 to 90 / minute

The subject's range of motion, womac scale with protocol-based exercises were recorded and analyzed statistically as below:

### Results:

His present physical condition as on 17.04.2018, ambulant with improved confidence, gait, cadence, active ROM of the knee have shown good improvement and functionally independent for driving.

These exercises helped the patient to overcome the identified list of problems stated above

**Table: 1**

Active ROM of the left knee in Phase II

	As on 16.02.2018	As on 17.04.2018
Prone	0 <sup>0</sup> -60 <sup>0</sup>	0 <sup>0</sup> -100 <sup>0</sup>
High Sitting	0 <sup>0</sup> -70 <sup>0</sup>	0 <sup>0</sup> -100 <sup>0</sup>
Standing	0 <sup>0</sup> -40 <sup>0</sup>	0 <sup>0</sup> -110 <sup>0</sup>

**Table: 2**

Results of protocol-based exercises using paired ‘t’ test Phase I with Womac scale

Phase I

Pre	Post	SD	SE	t	p
76	58	7.60	4.39	2.80	.05

**Table 3**

Results of showing the results of ‘t’ test with protocol-based exercises versus problem-based exercises using Womac scale

Phase II

Pre	Post	SD	SE	t	p
58	26	13	7.80	5.08	<.001

**Discussion:**

**Critical Analysis of these study findings with Evidence**

- 1. Should physiotherapist only follow the protocol or guidelines for ACL- R procedure?**
- 2. Evidence based on patients problems to be prioritized in physiotherapy?**

a. Weight bearing exercises are often included in the rehabilitation program as they or purported to minimize the strain on ACL (Ebben etal 2002) and lowers patella-femoral compressive forces compared to non-weight bearing exercises (Mueller etal 2013)

b. Neuromuscular strategies controlling the knee joint are highly varied (Boling etal 2006), hence rehabilitation treatment on improving the dynamic stability of the knee joint during functional tasks are most important (Wilk etal 2003)

c. this research subject was treated in Phase II using Proprioceptive exercises and dynamic exercises using neuromuscular strategies as supported by the above studies.

3. ACL being an anterior stabilizer and tibial rotation, any deficiency can often lead to articular cartilage injuries, functional instability, and osteoarthritis of knee (Biau etal 2007)

**3. Is it good to include various concepts for maximizing patient benefit?**

Total leg strengthening is defined as an exercise to joints proximal and distal to the joint in question are done to help decrease unwanted excessive frontal or transverse plane rotations that can occur due to proximal or distal weakness. Also lack of proximal trunk control can contribute to abnormal lower extremity alignment during functional exercises.

#### 4. Physiotherapy should address future complications that may arise later?

a. Quadriceps muscle weakness was often recorded post ACL – R. Hence neuromuscular control exercises are most important (William et al 2005) and Post ACL rehabilitation for 6 months period using Proprioceptive and core strengthening were shown to have improved motor power of quadriceps (Subramanian 2018). In a two year follow up post-ACL-R muscular deficits are reported and subsequent injury to either knee in 5 years follow up is 7% between the age group of 18-25 years (Shel Bourone et al 2009)

b. In line with these researches this study subject with 7 cm wasting of the quadriceps muscle on the ACL – R side, the subject has shown an increase in motor power and Vastus Medialis.

#### Conclusion:

Protocol for rehabilitation only forms the basic guidelines, adding patient-specific therapy along with protocol is ethical and maximize subjects early recovery and QOL

**Limitations of this original research** were single subject's therapy, and the outcome was analyzed. However long term follows up, larger sample size could further validate findings of this research.

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