Restoring knee range of motion in stage II infra patellar contracture syndrome is successful through physiotherapy - Case Studies

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Despite improvement in techniques of internal fixation and early rehabilitation, adequate knee flexion is not regained at times. This is especially so with associated gross soft-tissue injuries, multiple fractures, comminuted fractures and if rehabilitation is delayed. Adhesion and scaring of quadriceps over the femur, adhesion of patella with its surrounding structures are the important cause for limiting the knee range of motion.

Infrapatellar Contracture Syndrome (IPCS) - which is a knee condition with loss of both flexion and extension combined with 'patellar entrapment'. That is, the patella gets tethered down behind its tendon and above the notch of the femur and can no longer undergo its normal excursion.1

IPCS could be either primary (arising on its own) or secondary to one or more of a group of conditions - (immobility, quads insufficiency,2 poorly positioned cruciate ligament replacements, infection, RSD, an entrapped meniscus, or a neuromuscular disorder (such as polio). These conditions may be associated with a flexion deformity but a mobile patella, but if the condition persists a fibrotic (scarring) process may set in, and the patella may become immobile (entrapped) and then this would be 'secondary IPCS'.

Paulos LE and colleagues defined patients with IPCS under

Stage I - a prodromal stage - the knee - with inflammation and swelling around the joint, combined with weak quadriceps muscles, usually occurred 2-8 weeks after the initiating incident and the patients failed to progress with rehabilitation, to gain extension and had persistent pain and swelling with tenderness around the patellar tendon, and active ROM (range of motion) was painful.

Stage II - an active stage – between 6-20 weeks period after injury or surgery with significant decrease in patellar mobility, a hardened fat pad and a rigid patellar tendon. The mobility of the patella was severely decreased in all directions, and the patellar tilt test is zero or negative. The quadriceps lag was no longer present - i.e. both active and passive knee extension were limited.

Stage III - a residual stage - This may be from 8 months to years after the onset of IPCS, when the active process has effectively burned out. The quads muscles continue to be atrophied and weak, and flexion and extension continue to be restricted, with the patella infera and patellofemoral arthrosis as the only remaining features.

The management for stage I IPCS recommended by Palos LE and colleagues were aggressive rehabilitation with early motion, and patellar mobility exercises They emphasized getting the quads active, using as needed muscle stimulation, anti-inflammatory, analgesics (pain killers) and TENS (electrical nerve stimulation). It was suggested that manipulation under anesthesia (MUA) should also be used with caution and only in the very early stages. They recommend that these forced extension
procedures should not be used for more than 3-5 days. In their experience most patients in the early stages would generally respond to this programme, but 5% were still likely to progress to Stage II and require surgery. They considered this 5% to represent 'primary' arthrofibrosis.

Once it is apparent that no progress is being made and that the patient has entered Stage II, they recommended that attempts at forced passive extension be discontinued and that the patient should be treated surgically. They recommended open intra-articular and extra-articular debridement (clean up of scar tissue) and release (cutting bands of scar tissue), recommended that adhesions around the patellar tendon and the suprapatellar pouch should be excised, and patellar mobility restored with a patellar tilt test producing at least 45 degrees of tilt. They recommended that the surgeon be prepared to do a tibial tubercle transfer (moving the tubercle up) if patella infera was present.

With the pathophysiology being a hardened fat pad and a rigid patellar tendon causing decrease patellar mobility, an insight was given over the quadriceps muscle mobility also along with the patellar mobility.\textsuperscript{3,4} The question arised was, if the patellar fat pads – superior & inferior- are mobilized along with patella, and efforts are made to help the quadriceps muscle to slide over the femur smoothly, thus providing a possible support for the quadriceps to pull the patella and assist the patella to move over the groove will the range of motion be improved or not. If the ROM improves then the patient can be benefited by avoiding another surgery of fibrosis release or fat pouch excision. Hence an attempt was made to treat the patients with stage II IPCS through planned physiotherapy programme.

\textbf{Methods:}-From December 2011 to September 2013, 9 cases, aged between 34 to 56, who were complaining of decrease in knee joint range of motion following femoral & tibial surgery for various causes and re-advised physiotherapy treatment were studied. The patients were data are 3 comminuted fracture femur, 2 ACL reconstructions, 2 lower end femur fractures, 2 upper end tibial fractures. On examination it revealed that all the cases were advised for physiotherapy during their stay in the hospital and home program were given on discharge but they did no properly adhere to them. Their post operative period on reassessment ranged from 7 weeks to 16 weeks during the inclusion for the study.

On examination their passive knee ROM was between 0 to 45 degree flexion. 6 of the 9 cases had loss of passive extension also with pain being the major cause of concern. They had hamstring contractures which reduced the ROM. Patellar mobility was markedly reduced, especially the superior- inferior translation as compared to lateral mobility. Most of them showed a low patella position, loss of patellar tilt and loss of active patellar mobility on active quadriceps contraction. The quadriceps muscle pliability was less. The
muscle was not freely moving over the underlying femur. Picking up of the muscle was difficult as compared to the normal side. The patellar fat pad, both supra & infra patellar fat pad was not free and mobile.

Physiotherapy management was planned for recovering ROM (by providing intra-articular mobility, patellar mobility, q stretches, IT band stretches) improving strength, balance, proprioception and functional activity training along with pain relieving measures.

For improving patellar mobility, passive patellar mobility procedure with the patient in supine lying was done. All the movements of the patella (i.e.) superior and inferior glides, medial & lateral glides, oblique glides were done. To improve the superior glide of the patella, ligamentum patella / patellar tendon was mobilized, a superior forceful movement was done over the patella.5,6

To improve the patellar mobility and to provide space for the patella to glide, supra patellar fat pad and infra patellar fat pad were mobilized. Along with the fat pad mobility, the retinaculum was mobilized and stretched with force along with the patellar glides. Attempts were made to achieve the tilt of patella to smoothly slide over the femur. To improve the pliability of Quadriceps muscle to provide a good slide of the muscle over the femur for a good extensor sliding mechanism of the knee joint, muscle kneading, including finger and thumb kneading, circular kneading were done over the quadriceps bulk. Finger and thumb kneading was concentrated over the lateral attachment of the muscle bulk to the femur where the muscle gets fibrosed and is adhered over the femur. Circular kneading was given to relax the muscle, and increase elasticity of the muscle. To improve intra-articular mobility-joint distraction, posterior glides of needed grades, forced passive movements were done in tolerable pain limits. Positional release techniques were emphasizes to maintain & increase the tissue length and permanent deformation.5,6

Strength training by manual resistance and PRE were done through open & closed kinematic chain exercises. ISOKINETIC exercises by static cycling was encouraged in the available range with end rage resistance and hold for 10-20 seconds were done with in pain tolerance limits to achieve reduction in the synovial viscosity and aid joint mobility.7

Cryotherapy / hot packs were used when needed to increase circulation, relax the muscle or reduce pain.8

The entire programme was done with care to avoid any over pressure, exaggerate pain symptom, increase excessive tissue damage. The patients were strictly followed for 7-9 weeks regularly with 4-6 sessions/week. They were also taught home programme with advises, given a home programme chart, activity assessment of their wish to monitor improvement. Their hurdles that caused discontinuity or non adherence to treatment at home were sort and encouraged them for a regular exercise programme. They were assessed for their ROM every week +/- 2.

Result: - Of the 9 samples studied, only 8 were regular for treatment and one discontinued. After 4 weeks of treatment, as one patient did not show significant improvement as expected, he was referred for medical advice from dept of orthopedics. Data of 7 samples are analysed. The data were taken from the patients record file for analysis on interest. The mean ROM of the patients was 38degree of flexion before the treatment which was118 degrees after a period of 9 weeks of management.
Approximately the patients have achieved 70\degree of improvement in ROM after 9 weeks of treatment.

Following therapeutic management all the patients showed good improvement. Satisfactory improvement was achieved in 4 weeks of planned management on 5 of the 7 cases. An average of 18-20 degree improvement is seen till 4 weeks. The improvement in ROM is very evident after 3 weeks of treatment and there is a steep rise in the increase in Rom after 4 weeks of management.

The mean improvement in ROM was calculated & repeated measures ANOVA F with P<0.05 showed significant improvement. Dunnett test for multiple comparisons for knee ROM revealed that 5th week onwards there was statistically significant difference in the knee range of motion p<0.05.

Table-1 – ANOVA showing the significance of treatment.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>DF</th>
<th>Variance Est (MS)</th>
<th>F</th>
<th>P</th>
</tr>
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<tbody>
<tr>
<td>Between Subjects</td>
<td>8.606e+04</td>
<td>7</td>
<td></td>
<td>23.904</td>
<td>&lt;0.005</td>
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<tr>
<td>Within Subjects</td>
<td>4.984e+04</td>
<td>72</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Treatments</td>
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<td>9</td>
<td>4284</td>
<td></td>
<td></td>
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<tr>
<td>Residual</td>
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<td>179.2</td>
<td></td>
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</tr>
<tr>
<td>Total</td>
<td>1.359e+05</td>
<td>80</td>
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</table>

Graph – 1 change in the knee mean ROM after every week of management.

**Discussion:**

IPCS is a pathomechanics that is often considered as a regular problem of knee stiffness. This is common in patients who do not adhere to the exercise program. They are often called for revision surgery either for quadriceps plasty of for fibrosis release. Stage II IPCS is a clinical condition where it is often taken for revision surgery.
In this study almost all the patients had achieved their functional ROM of the knee joint if not the full ROM which indicates that physiotherapy is an excellent method of bringing back a patient to functional status.

For any problem the question for any patient is when will it be normal? Or how long will it take to be normal? When the management procedures take a long time they do not wait for the complete rehab programme and the next step is to accept surgery as advised by an orthopedic surgeon. This lack of patience is one important cause for recurrent surgical process.

Pain is one factor the patient has to tolerate during a non-invasive management which they fear to accept it and experience it.

This success is because the basic pathology & the pathomechanics were understood, the cause for decrease ROM was analysed and a planned programme was administered. Through out the management the patients were not administered to forced passive movements and movement beyond the pain tolerance capacity of the individual. This avoids the fear of pain in a noninvasive management and assistance with ICE or TNS were also helpful for pain reduction during & after the management.

Massage is an excellent therapeutic maneuver that has contributed for improving the pliability & elasticity of the muscles.\textsuperscript{9} It has helped in mobilizing the soft tissues around the knee joint & the quadriceps muscle. Patellar mobility, quadriceps stretches & strengthening have been very much contributory.

All the maneuvers have been useful in improving the ROM of the knee joint, but the significant improvement was evident only after 3 -4 weeks of treatment and thereafter the improvement has been significant. This could be because the soft tissues take that time to become released of the adhesion and for permanent elongation of the tissues to happen.

**Conclusion:**
The study concludes that Restoring knee range of motion in stage II infra patellar contracture syndrome is successful through physiotherapy but this improvement can be significantly evident only after 3-4 weeks of continuous supervised rehabilitation programme. The therapist and the patients have to wait for that period of time to identify any positive significant change in their knee ROM

**Limitation:** This study is limited to itself. As this was partially a retrospective analysis with clinical case records, it did not evaluate the functional status of those patients.

**Suggestions:** - as the sample size was small, future research is suggested on a larger population. Further research is suggested in form of multi centered randomized control trials to improve the level of evidence.

**References.**
3. Noyes FR, Berrios-Torres S, Barber-Westin SD, and Heckmann TP. Prevention of permanent arthrofibrosis after anterior cruciate ligament reconstruction alone or