

SCIENTIFIC BASES IN ACCELERATED PHYSIOTHERAPY IN THE RECONSTRUCTION OF LCA WITH PLASTIA H-T-H. SECTION III

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• MUSCLE REINFORCEMENT :

Mechanisms of Muscle Atrophy:

The muscle immobilization produces a 30-47% atrophy. The installation is very quick and increases with time exponentially (**Booth, 1987**).

-**Lindhoe, 1984** : he demonstrates that there is a 14 to 17% fibre lost after 72 hours of immobilization in men. This atrophy comes together with a reduction of muscle force and fatigue, this is a selective reduction of type I fibres.

-In a knee instability, **Gerber, 1985**, has demonstrated through scanner that there exists a quadriceps atrophy between 10% to 14% for ischios. The quadriceps atrophy is predominant at the inner vastus. The author estimates that the clinical average of atrophy doesn't reflect real changes in muscle shortage.

-Therefore, the measuring of the volume of the atrophied limb is not reliable in order to identify the muscle atrophy. A difference of 12% in muscle volume is equal to a reduction of 40% of muscle fibres. Consequently, there is an important clinical subestimation when we only take into account the clinical measure data.

-A reduction of 4 or 5% in diameter in the 1/3 medium of the thigh is equal to 22-23% muscle fibre reduction.

-Through biopsy, it is not seen a reduction of type II selective fibres (strength, isocynetic speed) in relationship with the type I fibres (resistance and posture). This author questions intensive ischio re-education of ischios which are little reduced in order to recover muscle balance (**Gerber, 1985**).

-**Jose Manuel** : he has checked that certainly ischios are slightly reduced after surgery, with isocynetic evaluation, and that they almost achieve 80% of their strength 2 months after the post-op (the valuation was done in different velocities in order to involve the different muscle fibres). It is possible that it exists a direct correlation between muscle strength shortage and the excentric workout of quadriceps overall, and functional instability by the time the therapy ends.

-The Gerbert study is in slight contradiction to **Baugher, 1984**, who says that there is a relative reduction of type II fibres. This author foresights the re-education to be more specific on these type of fibres.

-The Isometric Maximal Voluntary Contraction is reduced in a 70-90% after a arthrotomy 4 days postoperatory later, and it is reduced in a 40% after 2 weeks.

-The joint effusion acts as a inhibitory element of quadriceps. 10-30 ml is enough to produce an muscle fibre inhibition in a 60% (**Charcot, 1889**).

-The livocaine injection allows a supplementary increase of an 8%. **Fahrer** experienced that muscle strength increased in a 13'6 % when draining 50 ml of synovial fluid.

-This generates big implications in re-education:

1) To reduce effusion: Suction+Drainage + NSAID.

-**Young** : verified that the quadriceps inhibiting due to the effusion action reduces when the knee is at 30° flexion, more than whenever the limb is in complete extension. This probably happens because intraarticular pressure is less at 30° than in complete extension.

-After arthroscopy (**Shermann, 1984**), inhibition is 2 times shorter than arthrotomy. This certainly happens because there is less capsular damage with arthroscopy.

• HOW SHOULD YOU FIGHT AGAINST ATROPHY PROTECTING LCA PLASTY?

-During exercise, the level of forces at which LCA is subjected in the several activities is variable and different.

-This is due to the fact that the neoligament LCA may be mechanically damaged:

1) Because of an excess in the force producing its rupture.

2) Because of the cyclical elevated forces, producing a fatigue rupture.

3) Because of a plastic elongation.

Observations to consider in muscle workout:

-The Ho-contraction of Ischios/Quadriceps seems to be today the more secure method.

-Percutaneous electric stimulation reduces post-op atrophy (**Erickson, 1981**).

-Mobilisation and exercises against resistance at variable speeds in order to recruit the different types of muscle fibres in an early stage has enormous interest (Shermann,1982).

-The opposite-resistance must be placed in the TTA (**Jurist**,1985).

-A vigorous contraction on the opposite side produces an increase in muscle strength of a 30% of the side which has undergone surgery.

-**Yasada** ,1987 : confirms front subluxant action of the quadriceps in 0 to 60° flexion. The Ischios/quadriceps Ho-contraction provokes a back subluxation.

-**Jurist** ,1985 : insists on the fact that the front tibial subluxation varies according where the weight is placed in the quadriceps contraction. When the force is distally applied, the front subluxation is elevated. But when weight is placed proximally, a back subluxation takes place, not being dangerous for LCA.

-**Otis**,1986 : demonstrates that this effect is twice more important at 30° rather than at 90° flexion.

-Isometric quadriceps contraction produces a lot of tension on LCA at 0-40° flexion. The maximum is found at 0-15° flexion. This front subluxation is increased:

- 1) with weight at ankle level.
- 2) with an excentric contraction.

-The **Marklof** the evolution of the force applied to LCA, according to the knee flexion and the quadriceps contraction. FIG-2

-**Solomonov**,1987 : he demonstrates that there is reflex arc from LCA mechanicalreceptors. Ischios are excited and play a protection role. Quadriceps is slightly inhibited.

-When there is LCA absense, front tibia subluxation provokes a quick ischio response, indicating the existance of a reflex secondary arc formed by the muscle itself and the joint capsule.

-This reflex arc is slower, but it also does have a inhibitory action on quadriceps.

-The selective workout of ischio-tibials is very important in the front tibia subluxation.

-**Yack** : showed a meaningful reduction of the Lachmann test in the CCC exercise at 20° flexion, in comparison to the data obtained at the same angle in a CCA quadriceps workout, in the clinical evaluation of patients who had a LCA injury.

-The protecting role of CCC workout is explained by the fact that a ischio/quadriceps Ho-contraction workout is done. The front quadriceps transfer is antagonic to the back ischio transfer effect.

-**Savatsky** : on a mechanical model, he studied the mechanical forces that were exerted on a central pivot point during a static quadriceps workout in CCA according to the knee flexion angle and to the position of the resistance on the tibia. He demonstrated that all the weight placed on the tibia produces tension at the LCA whenever there is more than 10 cm from the femur-tibial interline and whenever the knee is in extension. The tensions which are exerted on the LCA during a static quadriceps workout in extension for a weight of 10 kg placed on the ankle are of 500 N, which will have repercussions on the plasty.

-This tension reduces with knee flexion and it is cancelled at a 80° knee flexion.

-This is the opposite than what happens at LCP level. The tensions exerted on the LCP for quadriceps are not meaningful, with the exception of 90° flexion.

-**Lutz** : he studied the front and back tibial movement at 30,60 and 90° knee flexion of static workout in lower limb CCC and in CCA for quadriceps and ischios. There are front transferring forces in CCA for quadriceps at 30-60° flexion (respectively of 300 and 200 N). There were not front transferring forces neither in CCC nor in CCA for ischios.

-The workout in CCC is responsible for a back transferring force of 500N at 30,60 and 90°.

-The workout in CCA of Ischios requests at LCP (100N at 30°,1500N at 60° and 1800 at 90°).