

# A New Method to Select and Promote Non-Surgical Healing of a Ruptured Anterior Cruciate Ligament

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## Abstract:

**Introduction:** Spontaneous healing of a ruptured Anterior Cruciate Ligament (ACL) has been observed for many years; however, the incidence of this phenomenon is low – approximately 10-15%. A novel method is described herein which aims to improve the chances of healing generally, as well as a selection process to increase the likelihood of healing in the cases selected with these criteria. It is hypothesised that this new method will achieve results comparable to those achieved surgically in selected patients.

**Methods:** Patients presented with a suspected ACL rupture based on history and examination. These patients were then imaged with a 3T MRI scanner adopting routine acute knee high-definition sequences in addition to a “double oblique” sequence. Patients were then divided into three groups based on these images and their position on the “spectrum of injury” the ACL has sustained. Group 1 deemed likely to heal, Group 2, deemed unlikely to heal and Group 3, uncertain healing likelihood. This latter group was then further divided based on patient specific factors that related to the risks of the new method and their ability or willingness to undergo the method. Approximately 56% of all patients presenting with a confirmed diagnosis of ACL rupture were subsequently referred to surgery based on the severity of the ACL injury sustained or patient preference, and the remainder, following consent being given under IRB review, commenced the new method, entitled “Cross Bracing Protocol” or CBP.

The Cross Bracing Protocol immobilises the patient’s knee in a brace locked at 90 degrees for four weeks. The authors argue this is effectively a “Closed Reduction and immobilisation” of ruptured ligamentous tissues and initiates the “healing phase”. The fifth week the brace is extended by 30 degrees, keeping the restriction of no more than 90 degrees of flexion. Week 6 has extension blocked at 45 degrees, week 7 at 30 degrees, week 8 at 20 degrees and week 9 at 10 degrees. From week 10 the brace is set to zero-90 degrees. Weeks 5-12 are considered the “remodelling phase”. Rehabilitation exercises are commenced on day 1 and involved predominantly isometric contractions of the contralateral quadriceps and hamstrings. Exercises thereafter are performed in the available range of motion. At 12 weeks after commencing the Cross Bracing Protocol the brace is removed and a repeat MRI is performed also with the double oblique sequence. This MRI is to determine the healing outcome using the ACLOAS classification. Patients with a failure to optimally heal their ACL are then referred for surgery and the balance continue with post-bracing knee rehabilitation. Return to sport is not recommended until 12 months has elapsed and then only after meeting “return to sport” criteria.

**Results:** A total of 903 patients presented with a ruptured ACL and 503 were referred to surgical intervention at presentation. The remaining 400 underwent the Cross Bracing Protocol. Of this 400, 20 patients (5%) crossed over to surgical management after the 12-week MRI scan due to sub-optimal (ACLOAS 2) or absent healing (ACLOAS 3). A further 25 (7.5%) patients re-ruptured their ACL following return to sport after 12 months. The remaining 355 (87.5% of the braced cohort and 32% of all patients presenting with an ACL rupture) achieved a “healed ACL” (ACLOAS 0 or 1).

**Discussion:** This Cross Bracing Protocol is aimed to reduce and immobilise the ruptured fibres of the ACL and thereby enhance the potential for the ACL to heal without surgical intervention. This is analogous to the treatment of Achilles Tendon ruptures in equinus and the treatment of a mallet finger in an extension splint. The outcome of healing (ACLOAS 0 or 1) one third of all presenting ACL ruptures will greatly reduce the surgical burden of this commonplace and devastating injury. It remains to be seen whether this healed ACL has the same or similar strength as the original ACL and in comparison, to a properly performed reconstructive surgery. Re-injury rates will be one indication and, where possible, biopsy of tissues accessed during subsequent surgical intervention.

**Significance/Clinical Relevance:** This low-cost alternative for ACL ruptures, where appropriate, will provide a novel non-surgical path for approximately 50% of ruptured ACLs. While the quality of the healing process remains to be determined these early results are promising. The potential, in such cases, to retain the normal Femoral and Tibial insertion footprint offers the prospect of a more naturally functioning ACL after injury and healing.



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