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*Editor*

# Femoroacetabular Impingement

Springer

# Preface

*Femoroacetabular Impingement* (FAI) is a compilation of the work of many hip surgeons interested in this pathology. The ultimate goal of this work is to provide an updated knowledge of diagnostic and treatment aspects of this disease, collecting different points of view from experts around the world.

The classical publication of Smith Petersen in 1936, inadvertently favored the birth of a disease. Professor Reinhold Ganz in Berne became the father of FAI, clearly describing the mechanisms of injury and treatment. Since the first articles of Bern group, hundreds of publications have deepened in diagnostic and therapeutic aspects and have contributed to a rapid advance in knowledge of FAI. This book involves many of these FAI experts, who described different approaches to the injured hip joint. I greatly appreciate all their generous collaboration and patience with the difficulties in publishing the work. This book would not have been published without the invaluable support of MAPFRE Foundation. It would be a great satisfaction if the effort made by all authors, finally serves to facilitate understanding of femoroacetabular impingement.

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osteotomy due to acetabular retroversion) is similar to that following surgical osteotomy of the proximal femur or of the acetabulum. Patients remain in bed for about 1 week starting nonweight-bearing ambulation and partial weight-bearing ambulation after 8 weeks and, gradually, full weight bearing, and abandonment of crutches is authorized. Postoperative rehabilitation is similar to that for conventional proximal femoral osteotomy.

## Rehabilitation After a Mini-anterior Approach

If osteochondroplasty without labral detachment is performed, risks through a minimal invasive access are minimized with this approach. The rehabilitation period is shortened to 2 weeks [1, 20]. The patient is hospitalized for 48–72 h until the drainage can be removed. Eventually, the patient may need one more day in hospital. Prophylaxis with antibiotics and antithromboembolic and anti-inflammatory drugs (indomethacine) is recommended to prevent heterotopic calcification. The patient walks with crutches for at least 2 weeks; functional recovery exercises must be performed for 4 or 5 weeks. After this, the patient can progressively resume his/her physical-sport activities. Closed-chain exercises can be introduced from the third week. Care must be taken to prevent the formation of a retractile scar during the 5 weeks that the patient does physical therapy. During the first 2 weeks, a weekly ultrasound scan is taken to rule out the presence of effusion in the hip joint.

If osteochondroplasty with labral detachment and reattachment is performed, patients ambulate with crutches (partial weight bearing) during the first 10 days. If the retrolabral ulcerative lesion microfractures, partial weight bearing should extend to 3 weeks.

- *1st week*: Rest, cryotherapy every 2 h during the first 48 h after surgery. Use of an elastic compression garment is indicated. Soft kinetic therapy must be initiated in order to achieve 90° of flexion, 60° of abduction, 60° of external rotation, 10° of adduction, and 10° of internal rotation (pendulum movements and isometric quadriceps, gluteus maximus and medius exercises).
- *2nd week*: Suspension therapy must be introduced to achieve the ROM levels mentioned above. Ultrasound therapy and electrostimulation are applied to the quadriceps and gluteal muscles to promote stretching. Free ambulation is allowed once stitches are removed. ROM should be maintained.
- *3rd week*: Active resistance exercises and ultrasound therapy for the adductors and anterior hip muscles are introduced. Electrostimulation and stretching of quadriceps and gluteal muscles are carried out. Concentric exercises are resumed at the end of the 3rd week (cycling with a high-seat bicycle to reach maximum flexion of 90°, which can be supplemented by crawl/freestyle swimming).
- *4th to 6th week*: Assisted active and passive kinetic therapy. Progressive use of gluteus medius, gluteus maximus, and quadriceps muscles. At the 4th week, the anterior hip joint should be treated. This treatment should be identical to the standard treatment of rectus femoris avulsions (once the muscle is reattached at the end of surgery). The patient can start using just one crutch and start ambulating without crutches on the following week. Aerobic closed-chain exercises must be continued (e.g., cycling with a high-seat bike and swimming).
- *7th to 12th week*: For 2 weeks, kinetic therapy must be increased to achieve more than 90° flexion, internal rotation, adduction of 20°, abduction, and 70° external rotation. Closed-chain exercises are maintained. Cycling to achieve flexion >90°is encouraged depending on patient's clinical-functional evolution. Balanced proprioception exercises and exercises involving single-limb support at 20° of flexion and 30°–40° adduction and internal rotation are introduced.
- *12th week and further*: Introduction of the linear run, elliptic bicycle, intensification of aerobic training, and gradual introduction of usual sporting activities except for impact sports involving flexion such as kickboxing, soccer, tae kwon do, karate, and some exercises of contemporary ballet. These exercises should be deferred by at least 4 months, depending on evolution.

## Use of Pulsed Signal Therapy (PST) in Postoperative Rehabilitation

PST is a noninvasive way of treating musculoskeletal dysfunctions, such as osteoarthritis, osteoporosis, tendon lesions, herniated discs, stress fractures, and all kinds of muscle- and joint-related problems.

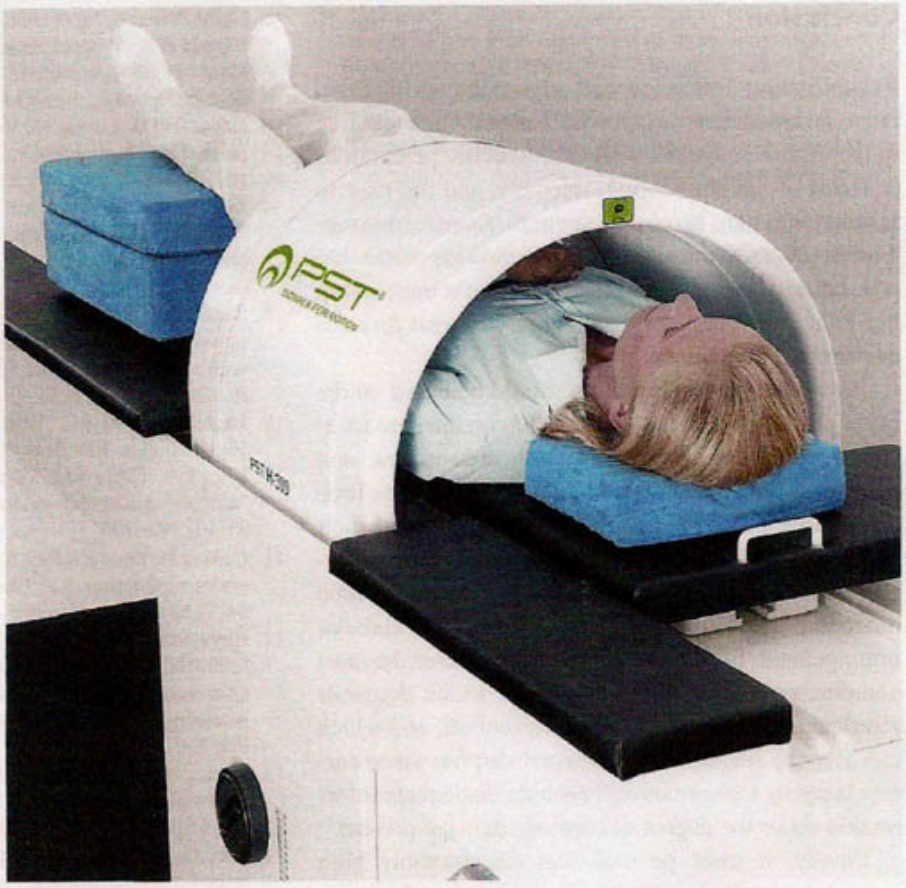


**Fig. 25.14** Pulsed signal therapy (PST) is applied just after surgery

Studies show pain reduction of 70–80% after nine 1-h sessions a day, applied directly around the cervical spine or knee articulation [21, 22]. Fioravanti et al. studied the effects of the PST waves on osteoarthritic chondrocytes cultured in alginate gel with and without interleukin 1 β (ILI β) and analyzed the proteoglycan concentration (PGs) in the culture medium and the chondrocytes' morphology after exposure to PST. They observed a significant increase in proteoglycan concentration (PGs) in the cultured cells exposed to PST. They explain that PST could possibly simulate a normal articulation in living beings. The cartilage is fixed, and as far as negative loads are concerned, when the cartilage is squeezed, it releases these negative loads toward the adjacent areas that have positive loads. When the compression is eased, e.g., during ambulation, these positive loads are attracted to the negative loads, giving rise to what is known as "streaming potential." The "potential of the electrical field flow" is a well-known term in Physics. It determines the incentive for regeneration and stimulation reactions, in other words, for maintaining and repairing tissue [23–25].

We have used PST mainly in patients having chondral lesions (submitted or not to microfractures) and noticed a beneficial effect of PST waves in these patients. Nevertheless, double-blind randomized studies are needed to confirm our preliminary findings. Besides, PST's healing and regenerating effect on connective tissue (the waves act directly on the pain-transmitting C-fibers reducing their intensity) seems to persist for months in these patients who, apparently, have a better prognosis as compared with treatments that do not use this drug-free and painless therapy that is exempt from side effects. Sessions must be held every day, soon after the physical therapy. The patient remains inside a PST OSTEO coil for 1 h a day up to a total of 12 sessions is completed (Fig. 25.14).

## Conclusion

Rehabilitation following femoroacetabular impingement is associated to specific restrictions regarding range of movement, as well as to specific precautions in terms of weight-bearing, intensity, and the time to resume activities involving strength. General postoperative rehabilitation protocols following total hip arthroplasty are not suited to every patient undergoing hip joint arthroscopy or open surgery to treat femoroacetabular impingement.

Postoperative rehabilitation should be based on the principles of tissue healing, as well as on the individual characteristics of the patient. Both arthroscopic and open procedures may vary widely due to the complexities involved in treating labral lesions [26] and their associated pathologies. Physical therapists are essential to develop specific rehabilitation protocols for each procedure performed to address femoroacetabular impingement. Indeed, FAI may be considered the most complex pathology of the hip joint, which demands absolute precision and timely intervention, and which can give the surgeon an unpleasant surprise since current imaging techniques still provide inadequate information about the degree of cartilage damage present.

Finally, it must be said that unreasonably high patient expectations may, in some cases, interfere with the postoperative outcome since it is not always possible to fully eradicate patients' symptoms and allow them to fully resume their usual sporting activities. Our knowledge of the hip musculature and biomechanics will continue to develop as so will our rehabilitation programs.

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