Aiding Recovery After Arthroscopy
Post-arthroscopic changes to the joint

Arthroscopy
Arthroscopic surgery is a valuable technique that has brought significant benefit to millions of patients. The procedure minimises disruption of the tissues surrounding the joint and has fewer postoperative problems than open surgery. However, arthroscopy may be associated with some surgical trauma, the most important features of which are pain, swelling and reduced joint mobility.1

Synovial fluid is flushed out of the joint during arthroscopy

During arthroscopy, the joint is flushed with irrigating solution to improve visualisation by distending the tissues, washing out debris and controlling any mild bleeding. Irrigation also leads to a loss of the synovial fluid, which is vital for joint function.

Hyaluronan in the synovial fluid
Hyaluronan is an essential component of the synovial fluid. It is a biopolymer made of repeating disaccharide units, which gives the synovial fluid its characteristic viscoelastic properties. It enables the fluid to act as a lubricant, a shock absorber and a filter controlling the movement of cells and large molecules within the joint.2,3

Under gradual shear stress, hyaluronan acts as a lubricant

Under sudden loading, hyaluronan acts as a shock absorber

Hyaluronan acts as a filter, hindering the movement of potentially damaging cells and molecules
**Hyaluronan in the cartilage and synovial membrane**

Hyaluronan forms a coating over the surface of the articular cartilage and the synovial membrane. This coating acts as a viscoelastic shield, protecting the joint structures from mechanical damage. Hyaluronan also protects from pain by masking the local nociceptors. In addition, the coating hinders the migration of free radicals and other inflammatory cells into the joint space.

Hyaluronan also forms the backbone of the proteoglycan aggregates that are essential for the structural and functional integrity of the articular cartilage.

**Consequences of the irrigation procedure**

During arthroscopy, the joint is flushed with irrigating solution, which washes out the synovial fluid and, therefore, hyaluronan from the joint. This displacement of hyaluronan leads to:

- Loss of viscoelastic properties, shock absorption and lubrication, causing stiffness and pain
- Loss of the protective hyaluronan coating of the cartilage and synovium, leaving these structures open to inflammatory mediators and mechanical damage
- Loss of the masking effect on nociceptors, resulting in increased pain.

In addition, the irrigating solutions used during arthroscopy may have a negative effect on the metabolism of articular cartilage.

**Post-arthroscopic symptoms may be associated with loss of hyaluronan from the joint**
Once the synovial fluid is flushed out of the joint, the balance of the articular environment is lost. Replacement of the synovial fluid with hyaluronan may promote restoration of homeostasis inside the joint.

### Restoring the articular homeostasis

Studies have shown that exogenous hyaluronan:

- restores cartilage metabolism following the physiological disturbance caused by irrigating solution\(^{15,16}\)
- protects the articular cartilage and synovial membrane from damage through its functional and structural properties\(^{17–25}\)
- suppresses chondrolysis of cartilage by reducing penetration of fibronectin fragments\(^4\)
- restores cartilage glycosaminoglycan content following 6 weeks of joint immobilisation; in addition, treatment with remobilisation and hyaluronan increased glycosaminoglycan content more than remobilisation alone\(^{26}\)
- promotes repair of degraded cartilage, reverses the damage caused by exposure to fibronectin or interleukin-1, and restores proteoglycan to normal levels\(^{27}\)
- promotes meniscal regeneration following meniscectomy and appears to inhibit degeneration of articular cartilage for up to 6 months\(^{28,29}\)
- stimulates collagen remodelling and inhibits swelling during healing of meniscal tears in a rabbit model of total medial meniscectomy\(^{30}\)
- stimulates the synthesis of endogenous hyaluronan\(^{31}\)
- promotes wound healing\(^{32}\) and the healing response following surgical laceration of the anterior cruciate ligament in rabbit models\(^{33}\)

**Saline irrigation significantly inhibits cartilage metabolism, as shown by reduced \(^{35}\)S-sulphate incorporation into proteoglycans. It is restored to normal by the addition of hyaluronan\(^{34}\)**

**Following partial meniscectomy, hyaluronan promotes meniscal regeneration compared with saline\(^{35}\)**

**Exogenous hyaluronan stimulates healing of damage to the anterior cruciate ligament (ACL)\(^{36}\)**
Introduction of exogenous hyaluronan into the joint space immediately after arthroscopy decreases postoperative symptoms. Hyaluronan has been shown to accelerate joint recovery by reducing pain and swelling, and improving joint function.

**Clinical benefit**

Hyaluronan has also been shown to achieve symptomatic relief by:
- reducing pain in the joint caused by pain mediators \(^5,34,35\)

In combination with arthroscopic surgery or lavage, hyaluronan is effective in:
- reducing pain and improving joint mobility in patients with chronic joint derangement\(^36–39\)
- protecting the joint and facilitating surgery\(^40\)
- relieving postoperative pain of the knee joint.\(^39\)

**Post-arthroscopic recovery may be aided by administration of exogenous hyaluronan**
Viscoseal®: product characteristic

What is Viscoseal®?
Viscoseal® is indicated for relief of pain and promotion of joint recovery following arthroscopy or joint lavage.

Composition
Viscoseal® is an isotonic solution of hyaluronan with a physiological pH that is designed to be used as a synovial fluid substitute. The concentration of hyaluronan in Viscoseal® is 0.5%, similar to that in synovial fluid.

Fermentation source
The hyaluronan in Viscoseal® is produced by bacterial fermentation.

Viscoseal® is a highly purified product; because it contains no animal protein contamination, the allergenic potential of Viscoseal® is negligible.

Presentation
Viscoseal® is presented in a 10-mL, mono-use container equipped with a Luer tip and packaged in a sealed sterile sachet.

Sterility
Viscoseal® mono-use containers are terminally sterilised by autoclaving. The device is sterile when packaged in order to facilitate aseptic use in a surgery theatre.
How does Viscoseal® work?

Following arthroscopy, Viscoseal® displaces any irrigating solution left in the joint space, preventing this solution from impairing cartilage metabolism.

Viscoseal® acts as a temporary substitute for the synovial fluid, restoring normal physiological functions. Viscoseal®:

- restores the lubricating, shock-absorbing and filtering properties of the fluid
- re-establishes the protective coating over the surface of the cartilage and the synovial membrane, hindering the migration of pro-inflammatory and catabolic mediators and protecting from mechanical damage
- reduces inflammation of the synovium
- alleviates pain by masking nociceptors
- enhances the production of endogenous hyaluronan.

How to administer Viscoseal®?

Viscoseal® is introduced into the joint space at the end of arthroscopic surgery, immediately after completion of the irrigation procedure. Viscoseal® can be administered by two alternative techniques:

- attach the Luer tip of the container to the portal already placed in the joint. Squeeze the container to introduce Viscoseal® into the joint
- aspirate the contents of the container into a syringe. Inject Viscoseal® into the joint cavity through a portal already placed in the joint.

If a drain is placed in the operated joint, introduce Viscoseal® and manipulate the joint for several minutes before opening the drain.
**General pain relief**

In a clinical study of patients who underwent knee arthroscopy, those treated with Viscoseal® reported a significant reduction in pain, measured on the 100 mm visual analogue scale (VAS), compared with those who underwent the standard procedure with saline lavage only. The improvement was significant 1 week after surgery (p <0.01) and was maintained for at least 1 month.41

**Pain relief and functional improvement**

Viscoseal® confers advantages over anaesthetic (bupivacaine) 3–6 weeks after arthroscopy.42 In a randomised study, patients undergoing arthroscopy received 10 mL of bupivacaine 0.5% or Viscoseal® following surgery. Patients who received Viscoseal® had significantly less pain measured on the VAS, required significantly less analgesia and had a significant improvement in function demonstrated by a larger decrease in WOMAC score (p ≤0.05) than patients who received bupivacaine.
Reduction in joint swelling

In another study involving patients who underwent arthroscopic partial meniscectomy and joint lavage, there was markedly less swelling in the joints of patients who received Viscoseal® (n = 20), compared with those who did not (n = 20). This reduction in the severity of swelling remained apparent at day 28.43

Effective in aiding recovery

In the same study, patients treated with Viscoseal® were more satisfied with their treatment than patients who underwent standard arthroscopy. Patients rated global efficacy over 1 month. At each time point, more patients in the Viscoseal® arm rated efficacy as optimum/good than in the control arm.43

Viscoseal® promotes pain relief, reduces swelling and improves function in patients recovering from arthroscopy
Rapid pain relief

A synergistic effect is seen when Viscoseal® is administered with a local anaesthetic.

Following arthroscopic shoulder surgery, 58 patients were given either 10 mL Viscoseal® plus 10 mL bupivacaine 0.5% or 20 mL bupivacaine alone. Patients treated with Viscoseal® showed improved pain relief. Indeed, among 28 patients who received Viscoseal® plus bupivacaine following arthroscopic shoulder surgery, 29% reported no pain 4 h after the operation compared with 0% in the bupivacaine group.44

Reduced analgesia consumption

In the same study, at 4 h post-arthroscopy, 25% of patients who received Viscoseal® plus bupivacaine required no further analgesia, whereas all of the patients in the bupivacaine arm required some form of analgesia. Moreover, only 11% of patients treated with Viscoseal® plus bupivacaine required opiates compared with 33% of patients who received bupivacaine alone.44

Reduced time to discharge from hospital

In addition to experiencing less pain, the 28 patients who received Viscoseal® plus bupivacaine were discharged in half the time taken to discharge those who received bupivacaine alone (5.2 vs 9.6 h; p =0.0001).44
Long-lasting benefits

Patients scheduled to undergo arthroscopy for degenerative osteoarthritis of the knee were randomised to Viscoseal® (n = 36) or standard treatment (n = 38). The relative benefit of Viscoseal® on pain when walking remained apparent 1 year after arthroscopy.

Viscoseal® reduced pain, when walking 100 m, for at least 1 year after arthroscopy.

Patients in the Viscoseal® arm also gave superior ratings for clinical global impression compared with those in the standard treatment arm.

Safety

The studies conducted with Viscoseal® have demonstrated the excellent safety profile of treatment. No adverse events relating to Viscoseal® have been reported in studies.

Viscoseal® provides both short- and long-term post-arthroscopic efficacy and has an excellent safety profile.
References


Prescribing information

VISCOSAL®: 0.5% Sodium Hyaluronate

Synovial fluid substitute.
10 ml mono-use container in a sterile sachet.

Sterile by moist heat.

Composition: Each 1ml of solution contains: sodium hyaluronate 5.0 mg, sodium chloride, disodium-hydrogenphosphate, monosodium-hydrogenphosphate and water for injections. The solution is isotonic.

Indications: To relieve pain, improve mobility and promote joint recovery by flushing out synovial fluid following arthroscopic procedures or joint lavage.

Directions for use: The contents and outer surface of the VISCOSAL® mono-use container are sterile as long as the sachet remains unbroken. VISCOSAL® should be used at the end of the arthroscopy after completion of the normal irrigating procedure. Remove the container from the sachet. Twist off the cap and remove the air bubble by squeezing the container. Attach its luer tip to a portal already placed in the joint. Introduce VISCOSAL® into the joint cavity by squeezing the container. This will help to wash out the remaining irrigating solution.

Precautions: The general precautions for arthroscopic procedures should be observed. VISCOSAL® should be instilled accurately into the joint cavity. As VISCOSAL® does not contain preservatives any solution not used immediately after opening should be discarded. Do not use if the mono-use container or sterile sachet are damaged. Store at below 25°C. Do not use after the expiry date indicated on the box. Keep out of the reach of children.

Contra-Indications: Known hypersensitivity to any of the constituents of the product.

Interactions: No interaction have been noted with the use of VISCOSAL® with other solutions for intra-articular use is available to date.

Characteristics and mode of action: Arthroscopy is a common procedure to visualise, diagnose and treat problems inside a joint. The joint is normally irrigated with solutions such as saline or Ringer lactate before and during arthroscopy in order to allow a clear view of the operation site and to rinse out debris. There is evidence that the presence of these solutions in the joint after irrigation may be detrimental to the cartilage. Furthermore, during the procedure the synovial fluid, which has particular viscoelastic and protective properties due to its hyaluronic acid content, is washed from the joint. Therefore, although the intervention may result in a long-term improvement of joint function, in the short-term patients may suffer from post-arthroscopy complaints like pain, swelling and impaired mobility of the joint.

VISCOSAL® has been developed to relieve these symptoms and promote joint recovery. It contains a highly purified specific fraction of hyaluronic acid produced by fermentation and is devoid of animal protein. Flushing VISCOSAL® through the joint cavity will help remove the remaining irrigating solution and efficiently coat all surfaces of the joint. VISCOSAL® left in the joint will act as a lubricant and an shock absorber and its macromolecular meshwork will prevent the free passage of inflammatory cells and molecules through the joint cavity. In addition, hyaluronic acid is able to promote wound healing.

Presentation: 1 x 10ml mono-use container of VISCOSAL® in a sterile sachet.

To be used under the direction of a physician.