Chondroplasty for Partial-Thickness Cartilage Lesions Using COBLATION™ Technology

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Chondroplasty for Partial-Thickness Cartilage Lesions using the WEREWOLF\textsuperscript{™} COBLATION\textsuperscript{™} System and WEREWOLF FLOW 50\textsuperscript{°} Wand

The following technique guide was prepared under the guidance of Ralph A. Gambardella, MD. Created under close collaboration with the surgeon, it contains a summary of medical techniques and opinions based upon his training and expertise in the field, along with his knowledge of Smith & Nephew’s products. Smith & Nephew does not provide medical advice and recommends that surgeons exercise their own professional judgement when determining a patient’s course of treatment. This guide is presented for educational purposes only. Prior to performing this technique, or utilizing any product referenced herein, please conduct a thorough review of each product’s indications, contraindications, warnings, precautions and instructions as detailed in the Instructions for Use provided with the individual components.

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Introduction

Chondral defects of the knee are quite common, affecting an estimated 10–12% of the population.\(^1\) Chondral lesions are detected at the time of surgery in nearly two-thirds of knee arthroscopy cases.\(^2\) Many defects are present with concomitant pathology, such as meniscal tears or ligamentous injuries. Since the introduction of arthroscopy, treatment has included lavage, debridement/chondroplasty and a variety of methods to stimulate the bone, including drilling, abrasion arthroplasty and microfracture. Many early studies also demonstrated promising results for arthroscopic debridement in the setting of degenerative joint disease of the knee.\(^3,4,5\) The purpose of this technique guide is to briefly review the anatomy and pathology of articular cartilage and to provide a technique for precise arthroscopic debridement of partial chondral defects using COBLATION\(^\text{®}\) Technology.
Articular Cartilage

The structural properties of articular cartilage create a low-friction contact surface for the knee joint. Knee articular cartilage (Figure 1) is only 2–5mm thick, but is durable enough to withstand forces up to five times body weight. Cartilage itself is avascular, and as a result, chondrocytes must rely on diffusion and anaerobic metabolism for nutrition. Because of this, the ability of articular cartilage to repair itself is somewhat limited. Dynamic loading of the knee is required for chondrocyte metabolism because it allows diffusion of nutrients and removal of waste products from chondrocytes.

A number of injuries can result in articular cartilage damage, most commonly involving a mechanical and traumatic injury. The lesion itself can result from a single incident or multiple smaller injuries. Cartilage defects can be described as focal or degenerative in nature.

Untreated lesions of articular cartilage have limited healing potential, and as a result are thought to be permanent and progressive. The sequence of injury starts with fibrillation and breakdown at the chondral surface. Gradually, surface delamination leads to cartilage swelling due to increased permeability. Proteoglycans are lost, and collagen structure is damaged, resulting in decreased hydrostatic pressure and an inability to tolerate compressive loads. Loose chondral fragments within the joint can elicit mechanical irritation and synovitis. Injury to the individual chondrocytes can result in diminished collagen synthesis and increased release of metalloproteinase enzymes. The predominant repair tissue is fibrocartilage. Fibrocartilage does not have the same mechanical properties as hyaline cartilage and it does appear to break down over time.

For many years the Outerbridge Classification system was considered the standard way to describe articular cartilage defects. However, for the past decade, the ICRS Classification System has been adopted throughout the world as the gold standard to be used for both clinical and basic science research.
Clinical Evaluation

The evaluation of a patient with a chondral injury begins with a thorough history. The clinical presentation of articular cartilage lesions can involve an insidious onset of discomfort or an acute traumatic event. Upon examination, the findings are often fairly nonspecific. Patients may have localized tenderness to palpation, and an effusion may be present. Almost all chondral injuries will have negative radiographs, and additional imaging in the form of MRI should be obtained. Articular cartilage can be well visualized on T2 fat-suppressed, proton density and gradient echo sequences.

Surgical Treatment

The gold standard for assessment of a chondral injury is direct arthroscopic examination (Figure 2). Diagnostic arthroscopy allows the surgeon to characterize the lesion in terms of its location, size, shape, depth and ICRS classification.

Chondroplasty is one of the most common arthroscopic procedures performed in the knee. The procedure allows for the removal of loose and fibrillated fragments of articular cartilage. By removing the damaged cartilage, chondroplasty creates a smoother articular surface and produces a more stable rim around the remaining defect. Care should be taken during chondroplasty to minimize the damage or removal of the surrounding normal articular cartilage. Arthroscopic debridement also allows for removal of loose bodies and chondral fragments that may be contributing to mechanical irritation and synovial inflammation. Debridement of damaged articular cartilage has been shown to produce at least a temporary relief of pain and improvement of symptoms. Chondroplasty may have the potential to stimulate a healing response in chondrocytes, but debridement itself has never been demonstrated to decrease the progression of degradation of the remaining articular cartilage.
Chondroplasty Using COBLATION® Technology

This technique focuses on the treatment of ICRS Grade 2 (Figure 3) and 3 (Figure 4) partial articular cartilage lesions and the removal of damaged and diseased cartilage fragments. Both clinical and basic science studies have shown improved results using COBLATION Technology compared to mechanical debridement alone with this type of defect. Spahn and associates' compared chondroplasty using COBLATION Technology to mechanical debridement for the treatment of focal chondral lesions of the knee in patients with concomitant medial meniscectomy. The authors found significantly better KOOS scores in the cohort of patients undergoing chondroplasty using COBLATION Technology with long-term outcomes. Additionally, the mechanical chondroplasty group had an increased rate of subsequent surgical interventions and greater evidence of joint space narrowing on follow-up radiographs.13 Owens and colleagues14 compared the results of monopolar and bipolar coblation chondroplasty for the treatment of Grade 2 and 3 lesions of the patella. The authors found superior Fulkerson-Shea scores in the bipolar group at one and two years after surgery.

Successful treatment of the edges of these lesions has also been shown to limit progression of the defect. A study by Voloshin and colleagues15 looked at 15 patients who had undergone chondroplasty using COBLATION Technology and returned for a second-look arthroscopy 0.7 to 32.7 months later. The authors found that only 3 out of the 25 chondral lesions (12%) demonstrated evidence of progression. At the time of the second arthroscopy, more than half of the chondral lesions had been at least partially filled with reparative tissue.15
Case Setup

A traditional two-portal (anterolateral and anteromedial) arthroscopy will suffice in most cases to perform a successful and precise chondroplasty. While additional portals may be necessary, the WEREWOLF® FLOW 50° Wand (Figure 5) has an optimized profile and angle that allows the surgeon easy access to almost all cartilage pathology via a two-portal technique.

It is recommended that all chondroplasties be performed using the COBLATION® (yellow) mode and not in the Coagulation (blue) mode. The WEREWOLF System and FLOW 50 Wand using Lo mode (Figure 6) is FDA-cleared for chondroplasty and articular cartilage debridement. This low-energy, low-suction setting minimizes damage to surrounding healthy chondrocytes and is therefore the preferred setting for articular cartilage removal.
Arthroscopic Coblation Technique

The distal tip of the WEREWOLF™ FLOW 50° Wand has a ceramic insulator with an angled edge that allows the surgeon to place that area of the device directly onto the joint surface. The plasma field forms only on the active electrode, allowing the ceramic border to be used as a guide for stable debridement with tactile sensation. Using the Lo mode, the wand is placed on the targeted tissue at an approximate angle of 45°. (Figure 7) This will position the plasma field a specific distance away from the joint surface, which is ideal for tissue removal and optimum for minimizing the depth of penetration. Increasing the angle of the wand in relation to tissue will increase the amount of tissue removed; decreasing the angle will decrease the amount of tissue removed. (Figure 8)

Layer by layer tissue excision (Figures 9 – 11) using short periods of activation will help ensure that minimal amounts of healthy tissue are removed. In most instances, working from posterior to anterior or side to side provides optimal visualization of the wand tip as well as the chondral lesion. The wand can also be used to probe the cartilage to assess the integrity of the tissue and stability of the lesion border. Once the borders of the lesion are smoothed and sufficiently stabilized, proceed to address other lesions or pathology that may be present in the joint. Both lesions of the trochlea and condyles will be treated in the same fashion.

Use of various modes on the WEREWOLF™ System allows the surgeon to treat different tissue types with the optimal balance of efficiency and precision. The Lo mode automatically modulates suction and energy output to produce desired tissue effects on delicate cartilage. With low wand suction and low output power, there is reduced risk of high temperatures or current being dissipated into the surrounding tissues. Although continuous suction flows through the device even when it is not activated, there is a higher occurrence of bubbles due to the lower suction settings in Lo mode. This is especially true when working on cartilage close to the tip of the arthroscope itself.
Occasional excess bubbles can be managed by working with short activation periods, which lessens the production of bubbles that may temporarily obstruct the view. It is important to ensure that the tip of the arthroscopic lens has been wiped clean prior to beginning the case to minimize bubbles from adhering to the scope. If needed, an 18-gauge angiocatheter can be introduced into the suprapatellar pouch to allow additional flow away from the arthroscope to aid in visualization.

Conclusion

Chondral defects of the knee are extremely common, and despite years of experience, we know relatively little about the natural history of these lesions. Symptomatic focal chondral defects are believed to continue to cause symptoms and discomfort. Appropriate patient selection is critical in maximizing the outcomes of arthroscopic surgery in the context of these chondral lesions. It is always the surgeon who must make the decision to remove damaged and diseased cartilage.

COBLATION™ Technology is currently the most reliable and effective way to treat partial articular cartilage lesions that are symptomatic and require surgical treatment. It provides an effective, safe and more precise method to remove damaged and diseased cartilage than any other method today, and when used properly, it has been shown to provide a better outcome for patients with these conditions.
References

Ordering Information

To order the items used in this technique, call +1 800 821 5700 in the US or contact an authorized Smith & Nephew representative. Prior to performing this technique or utilizing any product referenced herein, please conduct a thorough review of each product’s indications, contraindications, warnings, precautions and instructions as detailed in the Instructions for Use provided with the individual components.

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<th>Reference #</th>
<th>Description</th>
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<td>72290043</td>
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<td>72290037</td>
<td>FLOW 50™ Wand</td>
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Indications for Use

The FLOW 50 Wand, in conjunction with the WEREWOLF Controller, is indicated for the resection, ablation, and coagulation of soft tissues and hemostasis of blood vessels in several arthroscopic and orthopedic procedures. Please consult the Indications For Use (IFU) for a full listing of procedures.

Caution: U.S. Federal law restricts these devices to sale by or on the order of a physician.
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