Technical Note

Patellar Microfracture: Internal Stabilization House-on-Stilts Technique to Achieve Better Results

Christopher Chun Hei Yip, M.B.B.S, and Daniel Kwok Hing Yip

Abstract: Microfractures are the common first choice for the treatment of osteochondral lesions, because of their high efficacy and low cost and operating time compared with other surgical techniques. Results of microfractures for retropatellar chondral defects are subpar compared with other compartments of the knee, despite the patellofemoral compartment being the second most common compartment for such lesions. One major reason for the inferiority is the mobility of the patella, which is most prominent when the patient's knee is extended, as is the case in this type of surgery. Traditionally, this obstacle was dealt with by applying manual pressure, which is unreliable and prone to technical difficulties, such as skiving of the awl and a narrowed operating view, as well as complications such as fractures. This Technical Note introduces a new technique, which we have named "house-on-stilts," that uses multiple Kirschner wire fixations through the patella and femur to immobilize the patella and is essentially an internal stabilization. This technique aids not only the microfracturing process but also the preceding debridement stage, at no increased cost or operating time.

Osteochondral lesions are common articular cartilage injuries that indicate surgical treatment.[1] A wide range of surgical techniques exist to treat these lesions, most commonly microfractures (MFx), autologous chondrocyte implantation (ACI), autologous matrix-induced chondrogenesis (AMIC), and characterized chondrocyte implantation (CCI). Many controlled studies have demonstrated the relative superiority of one technique over another, depending on factors such as the size of the cartilage defect, albeit with minor differences in clinically meaningful parameters.[2-6] From these observations, MFx has been favored over the others for reasons such as requiring a shorter operating time, the ability to be performed arthroscopically, significantly lower cost, and the quicker recovery time.[5-7]

Specifically within the knee, the patellofemoral compartment has been found to be the second most frequent location for the chondral lesions, after the medial femoral condyle.[8,9] An important factor identified that may influence the superiority of ACI over MFx is the localization of the defect: MFx were found to have less favorable results with patellofemoral lesions.[10] Another study attributed this finding to the complexity of the surgical technique, where the mobility of the patella and the relative position of the joint surface can lead to skiving of the awl,

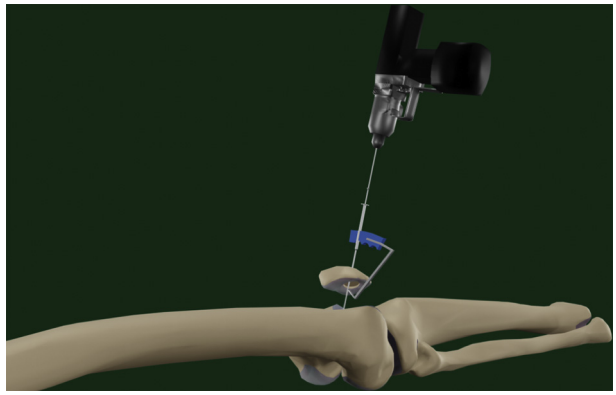

Fig 1. Illustration of right knee, viewed from the lateral side. Demonstration of the use of aiming device to guide the placement of the first K-wire, so that the exit trajectory of the K-wire will not enter an important area of the femoral cartilage. K-wire, Kirschner wire.

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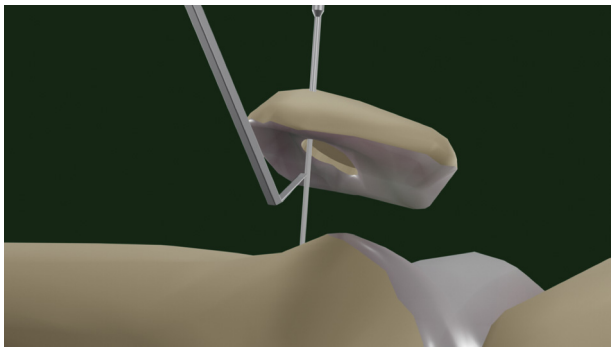

Fig 2. Illustration of right knee, viewed from the lateral side. Demonstration of the correct position of first K-wire at the edge of the chondral defect on the retropatellar surface. When the second K-wire is placed across the defect, this configuration will provide the greatest stability due to the greater distance between the K-wires. K-wire, Kirschner wire.

sometimes requiring a conversion into an open arthrotomy to complete the MFx.[11]

Traditionally, microfractures for retropatellar chondral lesions are performed with the patient in a supine position. The knee is fully extended in this position, and the relaxation of the quadriceps femoris allows for significant horizontal translation of the patella. This hypermobility of the patella is classically overcome with manual stabilization and counterpressure by an assistant, to permit the awl to penetrate the subchondral plate, which is tedious and unreliable. Too much pressure closes down the operating field, whereas too little pressure prohibits penetration of the awl. This is further compounded by the need of awls of significant angles of 70° or 90°, which makes penetration even more difficult owing to the difference of the hammering forces. A previous cadaveric study has shown that even experienced arthroscopists struggle with the microfracture technique,[12] indicating the necessity of a more reliable

Table 1. Pearls and Pitfalls

Pearls	Pitfalls
Use an aiming device in the initial learning phase	Drilling Kirschner wire (K-wire) into femoral articular cartilage, especially with first K-wire
Use a minimum of 1.2-mm^2 K-wire for rigidity	Placement of K-wires too close to each other, leading to poor fixation
Use 30° scope to avoid disorientation	Double-penetrating the femur with the K-wire, leading to damage to the femoral artery
Can use multiple superolateral portals where necessary to get perpendicular microfracture channels	
To prevent unnecessary trauma to the articular cartilage surface, the K-wires should exit the inner face of the patella, inside the boundaries of the defect	
A blunt instrument, such as a curette ring, can also be used to provide counterpressure during the first K-wire drilling and prevent collapse of the operating field	
The K-wires can be positioned in cross-wire configuration or a parallel wire configuratio, so as to avoid femoral chondral injury	

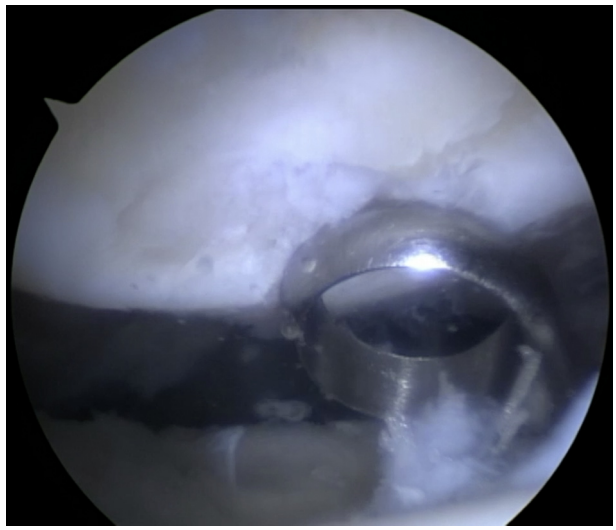

Fig 3. The patient is in a supine position, and the camera is viewing from the anteromedial portal. A curette, or any blunt instrument, can be used to apply counterpressure against the retropatellar, to facilitate the drilling of the first K-wire. K-wire, Kirschner wire.

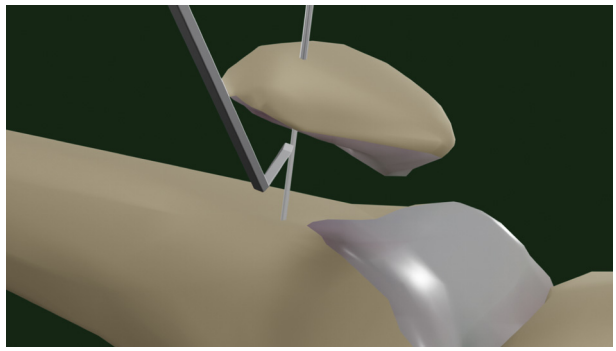

Fig 4. Illustration of right knee, viewed from the lateral side. Demonstration of the correct site of penetration of the K-wire away from the articular surface of the femur (to prevent unnecessary damage to the articular cartilage). K-wire, Kirschner wire.

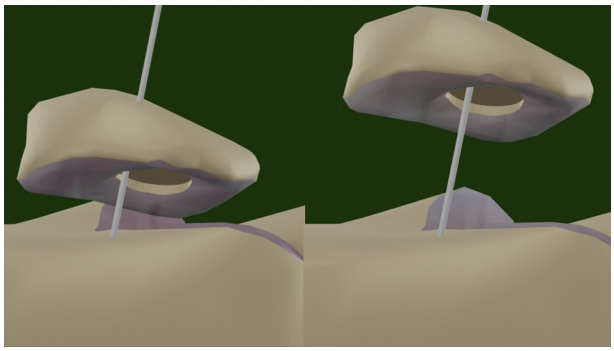

Fig 5. Illustration of right knee, viewed from the lateral side. Demonstration of the need to adjust the height of the patellar from the surface of the femur, to increase the operative field of view. The left side shows the patella being positioned too close to the femur, and the right side shows the optimum height of the patella, relative to the femur.

method. Specific technical advice for patellar microfracture is lacking in the current literature. This Technical Note aims to introduce a new technique for performing microfractures specifically for retropatellar chondral lesions, to enhance immobilization and optimize preparation of the chondral defect and penetration of the subchondral plate, which are different key stages of microfracture. No additional material or costs is incurred.

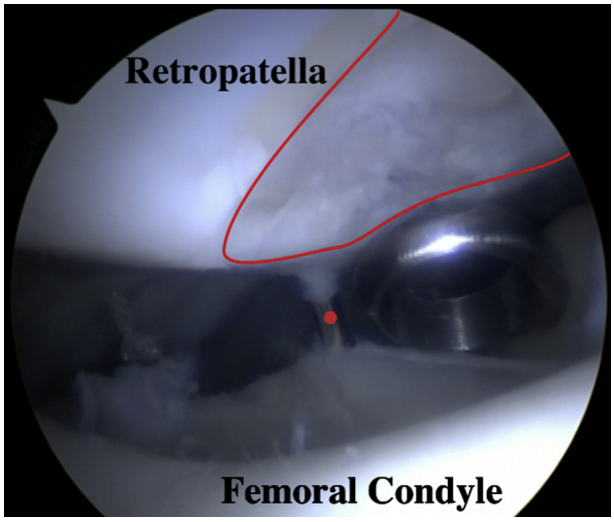

Fig 6. The patient is in a supine position, and the camera is viewing from the anteromedial portal. Misplacement of first K-wire (red circle) outside of the boundaries of the chondral defect (red line). When K-wires are inserted outside of the boundaries of the chondral defect, they do not have to be removed, as they still serve the purpose of immobilizing the patella and act as a reference for targeting the placement of the second K-wire. K-wire, Kirschner wire.

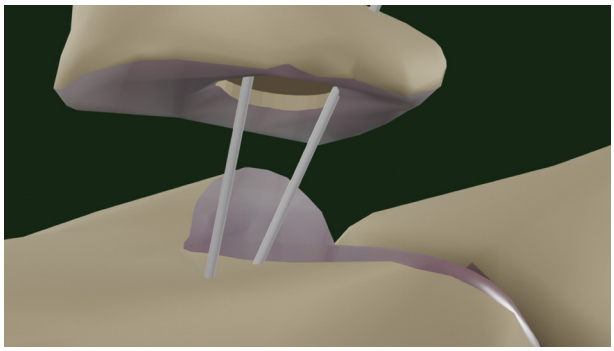

Fig 7. Illustration of right knee, viewed from the lateral side. Demonstration of positioning of the second K-wire, at a maximal distance from the first K-wire, to provide maximal stability to the fixation. K-wire, Kirschner wire.

Indications

1. Acute retropatellar localized chondral and subchondral injuries;
2. Localized lesion <2.5 cm^2;
3. Central retropatellar lesions.

Technique

In the supine position, the standard anterolateral and anteromedial anterior portals are initiated with 2 separate limited capsulotomies (Video 1). No special pieces of equipment re required to perform this technique, the steps of which follow:

1. Localize the site of the chondral defect.
2. Use any arthroscopic aiming device and pass the first Kirschner wire (K-wire) to the edge of the chondral defect (so that the exit trajectory of the K-wire will not enter an important area of the femoral cartilage) (Figs 1 and 2; Table 1).
3. (a) Use a blunt instrument, from inside the joint, to apply counter pressure against the entering K-wire

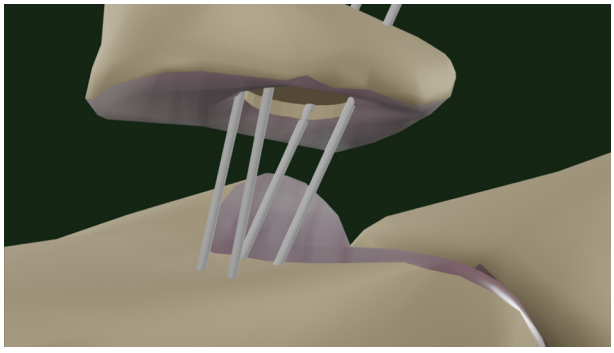

Fig 8. Ilustration of right knee, viewed from the lateral side. For larger defects, 4 K-wires may be used to maximize the rigidity of the fixation. K-wire, Kirschner wire.

Fig 9. The concept of this new technique originates from river houses built on stilts (red arrows) (commonly found in Asia) that allow a strong fixation of residential structures, against large external forces, such as floods.

(to maximize the joint space before the K-wire fixates into the femoral bone) (Fig 3). (b) Avoid drilling the K-wire through articular surface of the femur, which would create unnecessary iatrogenic damage (Fig 4).

4. (a) Adjust the fixation of this K-wire into the femur until the position and orientation of the patella are at an ideal height from the femur (further adjustments of the patella position and orientation cannot be made after subsequent K-wires have been inserted) (Fig 5). (b) If the first K-wire is placed improperly (i.e., not exiting through the chondral defect), it should not be removed but can be used to guide the second K-wire with angular adjustments to exit as desired (Fig 6). Subsequent K-wire entry can be done via individual skin portals or collectively through a 1.5- to 2-cm stab skin incision on the surface of the patella.
5. The second K-wire should be aimed so that it exits the patella a maximum distance from the first, across the long axis of the defect (Fig 7).
6. (a) For smaller defects, plan for three (1.2- to 1.6-mm) K-wire fixations in a triangular configuration, with the 3 wires maximally spaced. (b) For large defects, plan for four (1.2- to 1.6-mm) K-wire fixations in a rectangular configuration, with the 4 wires maximally spaced (Fig 8) (mimicking a river house built on stilts of the type commonly seen in Asia [Fig 9]).
7. (a) Once the patella is stabilized, proceed with debridement. Consider the use of additional portals if necessary. (b) Use a curette ring to fully debride the area of the lesion down to the subchondral bone. The debridement should extend laterally until the lesion is fully surrounded by stable rim of healthy cartilage.
8. (a) After proper preparation of the lesion, proceed to microfracturing. (b) Use angled awls to produce holes through the subchondral bone, ideally placed 3 to 4 mm apart as per standard protocol (Fig 10). (c) The holes created by the K-wires themselves will count as therapeutic microfracture holes, as if intentionally done using the retrograde principle. Furthermore, peripheral areas of the cartilage defect, which can be difficult to reached with the awl, can be accurately reached with more K-wire retrodrilling.
9. (a) Check for a successful result from the microfracturing. (b) Stop inflow and ensure the flow of marrow elements from the holes, as evidenced by the presence of fat emulsifications (Fig 11). (c) All K-wires are removed once adequate bleeding is visualized.

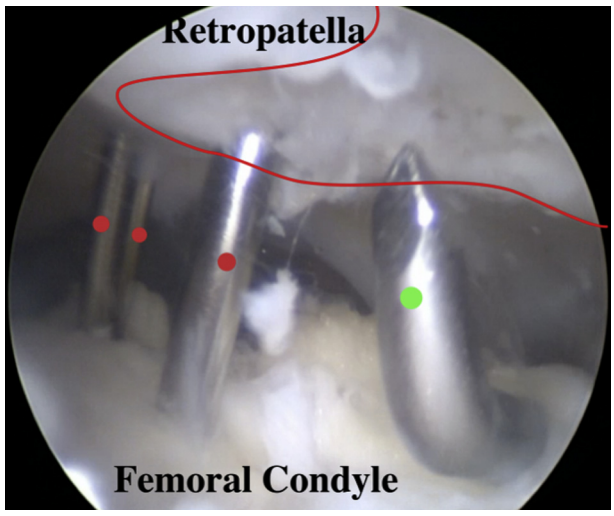

Fig 10. The patient is in a supine position, and the camera is viewing from the anteromedial portal. After the insertion of the K-wires (red circles), the patella is properly immobilized, allowing the awl (green circle) to penetrate through the subchondral bone inside the area of defect (red line). K-wire, Kirschner wire.

Fig 11. The patient is in a supine position, and the camera is viewing from the anteromedial portal. S successful result from the microfracture is confirmed by observing for fat emulsifications (asterisks) from the new holes.

Rehabilitation

The standard rehabilitation protocol for retropatellar microfracture surgeries should be followed: limited range of motion of 0° to 30° for 4 to 8 weeks with a limiting knee brace, full weightbearing, and a continuous passive motion machine as early as tolerable.

Discussion

The house-on-stilts technique allows for an easy and convenient method to stabilize the patella to facilitate the microfracture procedure, which can be performed by a single operator setup, as is usually the case (Tables 2). The traditional technique, which uses manual pressure by an assistant (of variable experience) to fixate the patella, is unreliable, allowing skiving of the awl, as the microfracture requires a considerable amount of force to be applied. This mobility of the patella permits much less penetrating force than that achievable for femoral or tibial lesions.

Using the K-wire, along with an intra-articular blunt instrument to counter the force during drilling, allows the patella to be immobilized at a maximal distance, above the femoral condyle. This increase in joint space can minimize the need for using a 70° arthroscope. Another advantage is that the increased joint space allows more room for maneuvering of the awl. This can help ensure that the tip penetrates the subchondral plate perpendicularly, allowing it to pierce through the full-thickness of the subchondral bone, for the microfracture hole to function (Fig 12).

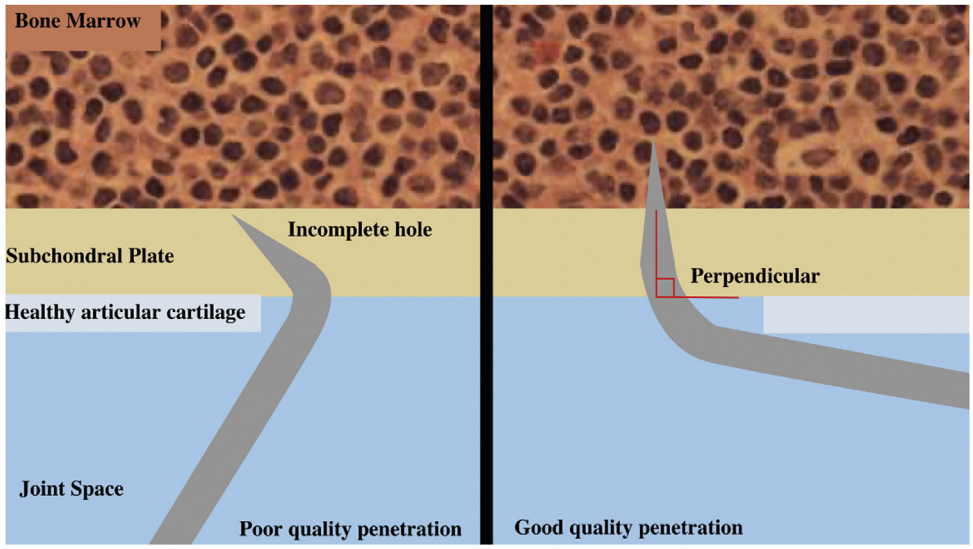

Fig 12. An increased joint space allows the awl to be positioned properly for the microfractures, at 90° to the surface of the subchondral bone (right), minimizing the risk of producing holes that are too shallow (left).

Table 2. Advantages and Disadvantages

Advantages	Disadvantages
Rigid fixation of patella for microfracturing	Additional surgical wound
No additional cost	Need of continuous passive motion equipment
Conventional, readily available instruments	Risk of iatrogenic chondral damage to femur
Reduced surgical time	Risk of stiffness from partial immobilization
Increased working joint space	
Allows the use of an aiming device	
Avoid skiving of awl during microfracture	
Short learning curve	

As the debridement process relies on manual tactile feedback, improved patellar fixation not only facilitates the microfracture process, but also aids in preparing the bony bed. Furthermore, the holes from the drilling can count as access to marrow stimulation elements, after the K-wires are removed. Difficult-to-reach peripheral areas of the patella are no longer an issue, and clinical results for patellar microfracture will perhaps improve compared with femoral microfracture results. Recent literature suggests that K-wire drilling is as effective as awl puncture,[11] contrary to earlier literature. Our own experience has shown no additional costs and a reduction in operating time, which could be essential when additional procedures are needed for concurrent pathology. The technique mimics river houses built on stilts, as are commonly seen in Asia, which look flimsy but have stood the test of time.

In conclusion, this improved technique can reduce the need of conversions into an open arthrotomy and thus avoid significant morbidity. Without additional caveats such as increased operating time or cost, this technique is recommended for all microfractures performed on retropatellar chondral defects.

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