Outcomes of Patellar Resurfacing in Total Knee Athroplasty

A Systematic Review & Meta-Analysis of Literature

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Master Degree in **Orthopedic Surgery**

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بسم الله الرحمن الرحيم
وَأَنْزَلَ اللهُ عَلَيْكَ
الْكِتَابَ وَالْحِكْمَةَ
وَعَلَّمَكَ مَا لَمْ
تَكُنْ تَعْلَمُ وَكَانَ
فَضْلُ اللهِ عَلَيْكَ
عَظِيمًا
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Introduction & Review

The patellofemoral joint is characterized as the forgotten compartment of the knee. Although a lot of progress has been made in regard to treatment of the patellofemoral joint, the orthopedist is still confronted with difficult clinical presentations. These areas in orthopedics remain as controversial, particularly after the failure of non-operative measures. Anterior knee pain may be due to injury to underlying cartilage, patellofemoral malalignment, trauma, soft tissue disorders, or a combination thereof. [1]

Patellofemoral contact area and pressure have been the subjects of numerous studies because patellofemoral articular lesions are believed to be a significant cause of the anterior knee pain syndrome. [2]

One of the important functions of the patella is to increase the mechanical advantage of the quadriceps musculature when extending the knee, with resultant large patellofemoral contact pressures. [3]

The long term results of patients treated with total knee athroplasty have revealed that 90% of cases had a 15 year survival rate. However, a considerable proportion of these cases reported poor functional outcomes and persistent anterior knee pain due to patello-femoral joint related problems despite an otherwise well performed knee replacement. Early prosthesis

used in total knee arthroplasty (TKA) lacked a femoral trochlea and biomechanics of the patella were not taken into consideration. As a result the option of patellar resurfacing was not involved. [4,5]

The role of patellar resurfacing in total knee arthroplasty (TKA) is still debatable. No clear consensus was reported by different studies regarding the mechanical and clinical significance of patellar resurfacing. Many surgeons choose to apply patellar resurfacing on a routine basis, others do not resurface the patella at all, A third group supports resurfacing the patella selectively.[6]

Authors advocating patellar resurfacing argue that the incidence of anterior knee pain is reduced and fewer revision surgeries are required. However, others opposing patellar resurfacing reported postoperative patellar loosening, osteonecrosis, patellar clunk syndrome, patellar fracture, maltracking, dislocation of patellofemoral joint and diminished or no difference in the incidence of anterior knee pain. [7,8]

The majority of the after mentioned complications were accounted for by poor surgical technique or inadequate prosthetic design.[9]

The exact pathology of anterior knee pain after total knee arthroplasty (TKA) is not fully understood. It is thought to be due to the presence of several substance P fibers in the nerves

associated with the patella and pre-patellar tissues, therefore it will be too sensitive to stimuli transmitting pain through afferent fibers [10].

It is suggested that patellar resurfacing should be limited to patients with severe preoperative patellar pain, cartilage degeneration, inflammatory arthritis, multiple knee surgeries, thick or large patella, patients with history of patellar maltracking, in addition to obese patients. On the other hand, insufficient patellar bone stock is known to be a major contraindication to patellar resurfacing [11].

The idea of patellar resurfacing relies on maintaining the thickness of the patella equal to or 1 mm less than the pre operative state by performing symmetrical resection of bone and keeping the extensor mechanism balanced. It appears that patellar resurfacing can be performed at any given stage of the operation and according to surgeon preference [12].

Patellofemoral Joint

The patellofemoral joint (Fig.1), which is a part of the knee joint, is a synovial joint. The articular surface of the patella is adapted to that of the femur, which extends onto the anterior surfaces of both condyles like an inverted U. The 'odd' facet contacts the lateral anterior end of the medial femoral condyle in full flexion, when the highest lateral patellar facet contacts the anterior part of the lateral condyle. As the knee

extends, the middle patellar facets contact the lower half of the femoral surface; in full extension only the lowest patellar facets are in contact with the femur. In summary, on flexion the patellofemoral contact point moves proximally. The contact area also broadens to cope with the increasing stress that accompanies rising flexion.[13]

Figure (1): Patellofemoral joint.[13]

Indications for selective patellar resurfacing

Little consensus exists regarding indications for patellar resurfacing. Current possible indicators include:

Pre operative anterior knee pain, patient obesity, Patellofemoral arthritis and patellar malalignment.

1- Anterior knee pain

Severe pre-operative patellar pain is considered a strong indication for patellar resurfacing. [14]

2- Body habitus

Increased Body Mass Index (BMI) is considered by many authours as a relative indication for patellar resurfacing, however it was hypothesized by some that perhaps joint loading and lever arm across the patella-femoral joint is more important than obesity in developing anterior knee pain.[15]

3- Patellofemoral arthritis

A clear evidence was found that the need for primary patellar resurfacing could be judged based on the intraoperative findings regarding the severity of patellofemoral disease. [16]

4- Malalignment

Some studies, looked at a comparison of postoperative patello-femoral alignment between resurfaced and nonresurfaced patellae, but none have investigated alignment preoperatively and compared this with outcomes post-operatively. It was found that lateral patellar displacement after patellar resurfacing was associated (but not enough power to prove statistical significance) with anterior knee pain, despite in many cases having less overall lateralization than knees without patellar resurfacing. Further work looking at pre-operative alignment and correlating this with post-operative outcomes is needed. [17]

Relative contraindications for patellar resurfacing:

1- The patella is too small or eroded to accept prosthesis

2- Younger patients with higher functional demands (due to higher complication rates of patellar resurfacing in young active patients).

3- Less than 20 mm of patella thickness. [15]

Burnett and Bourne performed a study of American National Joint Replacement Registry data and formulated a clinical algorithm (fig. 2) to help the surgeon decide whether or not to resurface the patella during total knee arthroplasty.[18]

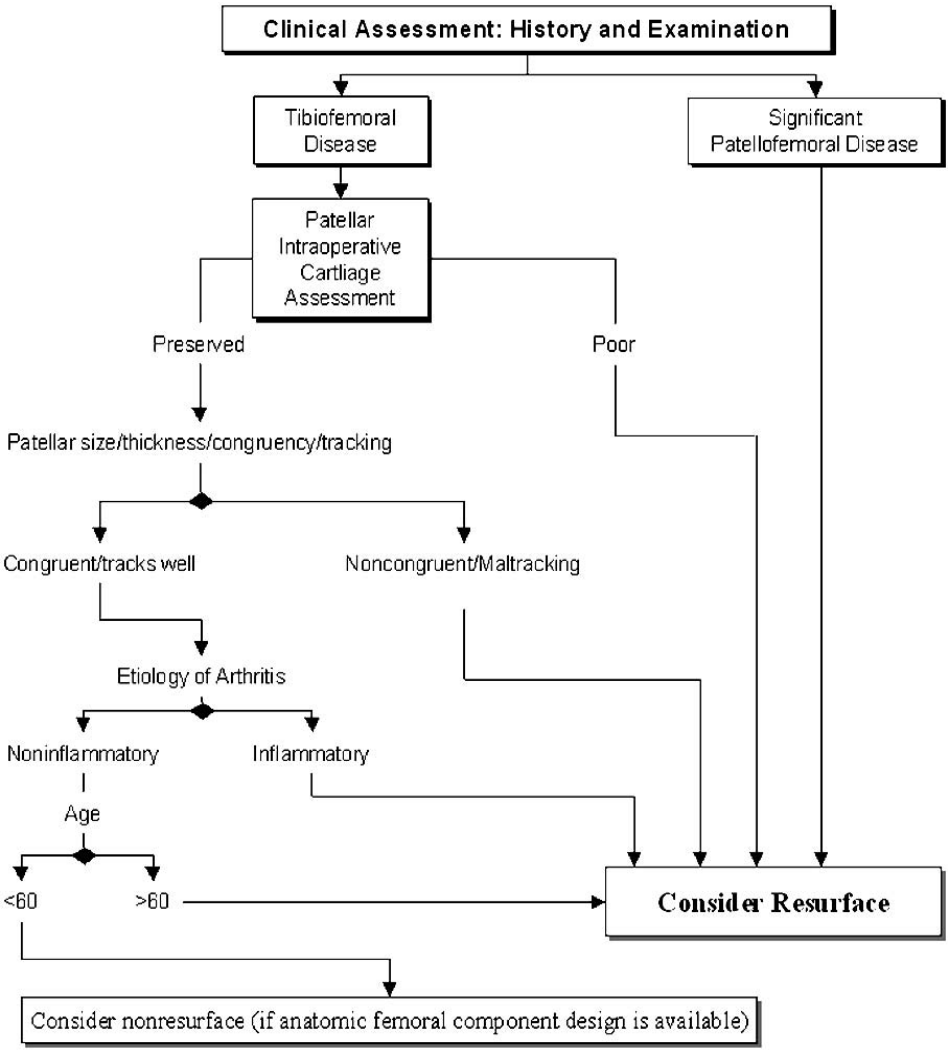

Figure (2): An algorithm to help the surgeon decide whether or not to resurface the patella during TKR is shown.[18]

(i) Resurfacing would be recommended if there is significant patello-femoral disease on history and examination.

(ii) If on pre-operative assessment there appears to be mainly tibio-femoral disease, then an intra-operative patellar cartilage assessment should be made and if assessed as poor then resurfacing performed.

(iii) If the patellar cartilage appears preserved then congruency and tracking are assessed with poor tracking and congruency requiring resurfacing.

(iv) If the patellar tracks well and has good congruency, then the arthritis aetiology is an important factor with patellar resurfacing considered for the inflammatory causes.

(v) Lastly, if the patient has non-inflammatory arthritis aetiology and is 60 years old, then resurfacing should still be considered.

Therefore, according to Bourne's algorithm patellar resurfacing can be avoided in patients that are younger than 60 years old with knee osteoarthritis, but without patello-femoral disease on history or examination and intra-operative assessment shows preserved patellar cartilage on a well-articulating and centrally tracking patella.[18]

Advantages and Disadvantages of Patellar Resurfacing

Advantages of patellar resurfacing

Resurfacing can relieve pain, improve a patient's ability to climb stairs and increase quadriceps strength. Numerous studies have demonstrated that substantial cartilage destruction in the patella occurred during secondary resurfacing due to anterior knee pain after TKA without patellar resurfacing. Revision rates for patellar resurfacing have improved as a result of enhanced implant design, refined surgical techniques, use of all-polyethylene patellae with three peg components, proper selection of patellar implant size and avoidance of over-resection of the patella. [19]

Disadvantage of patellar resurfacing:

Patellar resurfacing during TKA has a high complication rate. Such complications are: component wear, dissociation, loosening, patellar fracture and soft tissue impingement syndrome. Retaining the patella can reduce the complication rate.[20]

Patellar Resurfacing Technique

The first patellar resurfacing was performed in 1955 to treat anterior knee pain associated with patello-femoral arthrosis. This was done at the time as an alternative to patellectomy or patellar shaving, which was the then current treatment for patellar pain.[21] In the 1970s, there was high incidence of anterior knee pain associated with the poor early implant designs. Subsequent total knee joint replacement prosthesis designs have incorporated patellar resurfacing into their instrumentation, which has somewhat lowered reported post-operative anterior knee pain. Despite this, complications related to patellar resurfacing have led surgeons to reconsider routine resurfacing. During surgery, those surgeons that do not routinely resurface the patella make an assessment of severity of patello-femoral osteoarthritis. A decision is made to resurface the patella or not. When resurfacing of the patella is not performed, most surgeons carry out 'so-called' patelloplasty. This essentially involves removal of osteophytes around the edges, smoothing of fibrillated cartilage and drilling of eburnated bone (Fig. 3).[22] If the patella osteoarthritis is deemed severe enough to resurface, then patellar thickness is a very important factor in resurfacing success. Male patellar thickness averages 23–28 mm, and for women, the average is 21–24 mm. The implants available to surgeons range from 8 to 10 mm thick. Intra-operatively, a caliper is used to measure the central patellar thickness. The aim of measuring and cutting is to maintain the anatomical thickness, as it is commonly believed that this gives the best result. A residual bone thickness of 15 mm is required.[23] A patellar thinner than this is at higher risk of fracture given the high mechanical