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Keywords: *patellar resurfacing, TKA, total knee arthroplasty.*

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Replace the Patella in Total Knee Arthroplasty or Not. Always, Never or Selectively: What to Do?

Dr. Rafael Calvo [α], Dr. Daniel Paccot [σ], Dr. David Figueroa [ρ] & Dr. Sergio Arellano [ω]

Abstract- Wether to resurface or not the patella during total knee arthroplasty (TKA) remains controversial. Actually there is three options: always, never or selective resurface. Surgeons in favour of resurface say that non-resurfaced patients have more anterior knee pain and worst knee function scores. In the other side surgeons that leave patella un-resurfaced advocate that it avoids complications with similar postoperative results. This review will discuss the recent available literature on patellar resurfacing based on randomized controlled trials and published meta-analyses. Most of the meta-analysis seems to favour routinely resurfacing of the patella based on less re-operations. However, the most recent RCT show no difference between both options. So far, a method for accurately predicting which patients can avoid patellar resurfacing has not been found.

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I. Introduction

Symptomatic knee arthrosis is a very common disease with a prevalence of 3.8% of our population in 2010 and is increasing due to an aging population (1). The total knee arthroplasty (TKA) has improved the quality of life of millions of patients suffering from severe osteoarthritis in the last decade, and has become one of the most satisfactory procedures for both the patient and the surgeon (2). Some studies have shown that TKA is one of the most common procedures in hospitals actually (3,4). Despite this, some technical details of the surgical technique like patellar replacement remain the subject of debate today. Initially TKA designs didn't include a patellar component and was associated with high rates of anterior knee pain 40-50% (5,6). In 1976, Insall showed that in 4 different prosthetic designs, the most important problems were the post-operative anterior knee pain and encouraged the incorporation of patellar replacement in the TKA. A variety of complications have been attributed to resurfacing of the patella with an incidence of 4-50% including avascular necrosis, patellar fracture, patella tendon injury, patellar clunk, aseptic loosening, and polyethylene wear of the patella component (7). These complications have been associated to difficult revision procedure (8), leading to avoid routinely resurfacing the patella in TKA. Classically Burnett et al described indications of patellar replacement trying to get an answer for this dilemma(9). However, actually there is three options during surgery: always replace the patella, never replace it and perform a selective patellar replacement. Surgeons who always realize patellar resurfacing advocate that this procedure can reduce the incidence of anterior knee pain despite the complications. In the other side surgeons that never replace the patella advocate that the procedure is faster, cheaper and with no functional differences. Finally, the third group of surgeons decides during surgery whether or not to replace the patella under the conditions of articular cartilage, bone stock of the patella, patellar type and some individual characteristics such as weight and height (10).

The aim of this study is to summarize the recent evidence-based literature that is available to date and discuss the outcomes whether to perform or not routinely patellar replacement in TKA. The focus of this evidence-based analysis will be on the outcomes of anterior knee pain, reoperation, and patient satisfaction after total knee arthroplasty with and without patellar resurfacing

II. Methods

A literature review was performed in electronic databases PubMed, Medline and Embase, crossing the words "patellar resurfacing" and "Total knee arthroplasty". We excluded manuscripts that were not in English. All level I evidence studies published from January 2012 to October 2015 were included.

We found 139 that reached our inclusion criteria. Two independent authors assessed these studies with title, selecting finally 16 title. In the event of any inconsistency between the authors we included the paper to read its abstract. Sixteen summaries were evaluated, 8 of them were removed: 4 of them for being literature reviews and 4 for being retrospective studies. Finally, we find 8 level I evidence: Five meta-analysis of randomized prospective studies and three randomized prospective studies. Fig 1.

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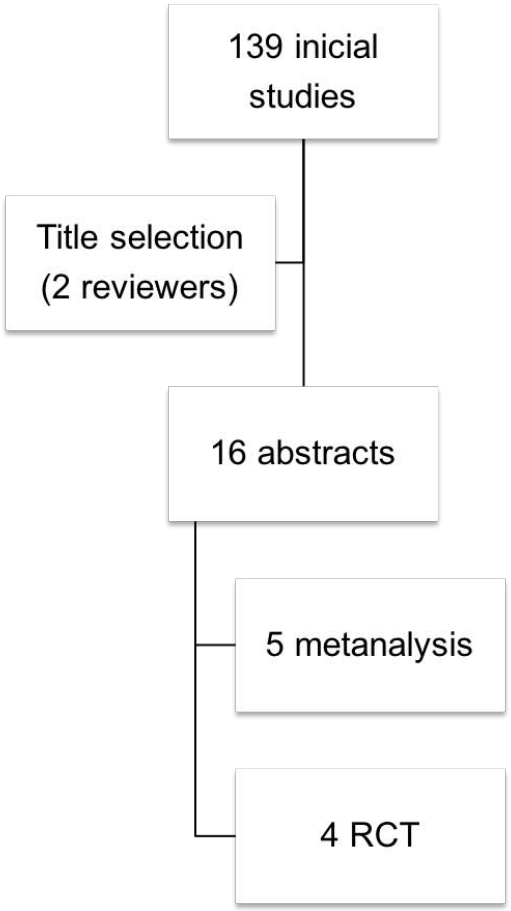

Fig Nº1: Flowchart of studies selection

III. Results

Five meta-analysis of randomized controlled trials and three recent controlled trials were found. Among the meta-analysis, five of them were of the year 2011. The first one seeks to compare the functional outcomes and postoperative complications of patients undergoing TKA with or without patellar replacement (11). This meta-analysis conducted between 1966 and 2009 included 16 randomized studies with a total of 3034 patients. As conclusion, they found that reoperations in patients without patellar replacement were significantly greater (p: 0.03), however, there was no difference in anterior knee pain and functional scales. The second meta-analysis evaluated 10 randomized controlled trials between 1966 and 2010 with a total of 1003 patients (12). This study concluded that the rate of reoperations decreased significantly by 4% (p: 0.06) and that by replacing the patella in 25 patients, a re-intervention was prevented. However, just as the previous study they found no significant difference in anterior knee pain. Finally, Pavlou et al (13), realized a meta-analysis of which included 18 randomized controlled trials with a total of 7075 patients. This study, unlike the two above, included the study by Tabutin et al from 2005 (14), which incorporated 5915 patients with TKA. This study concluded that the rate of reoperations in patients with patellar replacement was lower (p: 0.012) and that the rate of anterior knee pain and functional scales was similar in both groups. Due to the incorporation of Tabutin study the results of this meta-analysis are very similar to the one of this study.

In 2012, Pilling et al (15) performed a new meta-analysis including studies up to 2011 with a total of 16 randomized controlled trials and 3465 patients. This study concluded that the KSS(Knee Society Score) was higher in patients with patellar replacement (p: 0.005) and that there was a tendency to have a higher incidence of anterior knee pain in patients without patellar replacement (24% vs 13%); However, this difference was not statistically significant (p: 0.1). The rate of complications was higher in patients without patellar replacement (p: 0.02) as well as re-interventions due to anterior knee pain (p: 0.00001) and patellofemoral complications (p: 0.002). Finally, no differences were found in the infection rate, operative time and radiographic appearance.

The last meta-analysis found in the recent literature is the one of Chen et al in 2013 (16), which included randomized studies between 1966 and 2012. This study included 14 studies with a total of 1725 patients, finding similar results to the previous studies

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previously mentioned with respect to reoperations, complications and knee pain. One of the knew findings of this study was that in patients with more than 5 years of follow-up, KSS was higher in patients with patellar replacement (p: 0,002)

Several of these meta-analyses indicate as a conclusion that more prospective randomized controlled trials (RCT) should be performed to evaluate the utility of patellar resurfacing. In our research we find three recent RCT.

The first study is from Breeman et al (17), which began in 1999 and included a total of 1715 randomized TKA with and without patellar replacement. In their results, they did not find significant differences in knee function scales, reoperation rates and costs at 5 years of follow up.

In 2012 Beaupre et al (18) performed a prospective study with 5 and 10 years of follow-up assessing pain, function and reoperations including 38 patients. Functional scales and pain were increasing over the years in both groups with no difference between them at 5 and 10 years. There was no difference in reoperations rates between the two groups. The most recent prospective randomized study is that of Roberts et al in 2015 (19) who realized a prospective randomized study evaluating 350 knees excluding patella with bone exposure, beginning the study in 1996. This study demonstrated that patient satisfaction was greater for patients with patellar replacement, however, it was balanced when follow-up was greater than 10 years. On the other hand, when analysing functional scores, complications and prosthetic survival, no significant difference was found.

Author	Year	Number of patients	Conclusions
He et al	2011	3034	Resurfacing reduces the risk of reoperations after TKR. No difference in terms of anterior knee pain, KSS and knee function score.
Fu et al	2011	1003	Resurfacing reduces the risk of reoperations after TKR. No difference in anterior knee pain
Pavlou et al	2011	7075	Resurfacing reduce the risk of reoperations after TKR. No difference in anterior knee pain and knee function score.
Pilling et al	2012	3465	Resurfacing reduce patelofemoral complication and reoperation rate due to anterior knee pain. No diference in KSS score or knee function score.
Chen et al	2013	1725	Resurfacing reduces the risk of reoperations after TKR. No difference in terms of anterior knee pain, KSS and knee function score.

Figure N°2: Meta-analysis of randomized controlled trials of patellar resurfacing *vs* non resurfacing in primary TKA. KSS: Knee society score.

Author	Year	Number of patients	Follow up	Conclusions
Breeman et al	2011	175	5 years	No diference regarding functional outcome, reoperation rate and total health care cost at 5 years post TKR.
Baeupre et al	2012	38	10 years	No differences in knee function score at 5 and 10 years of follow up.
Roberts et al	2015	327	7.8 years	No difference in knee function score and complications. In follow up < 10 years: resurfacing with better satisfaction Infollow up < 10 years: No difference

Figure N°3: Randomized controlled trials of patellar resurfacing *vs* non resurfacing in primary TKA.

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IV. Discussion

In our research we found five meta-analyses and three RCT on whether or not replace the patella in TKS. In the five meta-analyses with evidence 1a, the conclusion was that there is a higher rate of reoperations in the patient group without patellar replacement; however, there are no differences in functional scales, patient satisfaction and anterior knee pain. In the other hand, when assessing the most recent RCT, there are no differences in functional scales, anterior knee pain, reoperations and costs.

Regarding meta-analyses, it is important to note that most studies are based on a similar database since they often include the same prospective randomized studies that have existed in the literature since 1966, all of which are methodologically similar. In second place we should mention that most patients come from older studies with different components and patellar replacement techniques. Currently there are different patellar replacement options that did not exist at the time of the first prospective studies and therefore we don't know if these new techniques decrease the incidence of anterior knee pain and knee function scores. Finally, the TKA has become a more common surgery nowadays and therefore improving surgical skills and achieving better results so we need more prospective RCT in the future to evaluate the actual TKA design.

In the other side we found three RCT with a well designed study that did not found statistical difference in both groups. Despite the fact that RCT are the best studies to evaluate an intervention, they have some limitations because this studies have few patients to make a statistical difference and it's difficult to isolate confounding variables. In order to eliminate this confounding variables, Burnett et al realized a RCT with 32 patients with bilateral knee arthorplasty, performing one knee with patellar resurfacing and the other one without. At 10 years of follow up, there was no difference with regard to range of motion, knee society score, satisfaction, revision rates, or anterior knee pain. Moreover, they found that 37% of patients preferred the resurfaced knee and 22% the non-resurfaced knee (20).

As mentioned above, one of the difference found in the meta-analyses (but not in RCT) is that resurface the patella in primary TKA decrease the reoperation rate. There is multiple etiologies of re-interventions, however, the most common cause is anterior knee pain. Burnett et al indicate in their study that there are several options for the management of patellofemoral pain, however in patients who have not undergone patellar replacement, the surgeon recommends an initial patellar replacement assuming that the pain originates in the patella (21). On the other hand, in patients with primary patellar replacement with anterior pain, an initial non-surgical management is generally performed. This would explain the higher rate of re-operations in patients without patellar replacement in the primary TKA (22). It should be noted that there are studies that demonstrate that patellar replacement in a second intervention does not manage pain completely, leading to worst knee functional score (23).

In patients without patellar replacement, there is some options to avoid anterior knee pain. One option is to realize a patelloplasty which include the excision and reshaping of the patella to better match de femoral component. Liu et al realized a randomized study of 133 patients between reshaping group and resurfacing group. They concluded that there was no difference between the groups with regard to the KSS, anterior knee pain rate and radiograph at a minimum of 7 years of follow up (24). Another option to decrease anterior knee pain is to realize a denervation to destroy nociception fibers in non-resurfaced patella. Li et al realized a meta-analysis of RCT of 657 knees comparing non resurfaced patella with and without denervation. They demonstrated that there was no difference in anterior knee pain and visual analogue score. However, they find knee function score and WOMAC score was significantly higher in the denervation group concluding that denervation might lead to less anterior knee pain and better TKA function. In our review we didn't find studies comparing resurfacing with denervation.

The third option during TKA is the selection of patients for patellar resurfacing. Bourne et al recommend not resurfacing in patients younger than 60 years, with well articulate patella and mild arthrosis (25). Barrack et al realized a RCT to evaluate factors that influence the results of TKR with or without patellar resurfacing. In this study; obesity, the degree of patellar chondromalacia, and the presence of preoperative anterior knee pain didn't predict postoperative clinical scores or the presence of postoperative anterior knee pain. They concluded that post anterior knee pain couldn't be predicted with any clinical or radiological parameter studied (26). Peng et al in their study also don´t recommend that weight or pre operative knee score be used to decide to resurface the patella or not (27). In the other side there is other studies that have show that weight is a predictive factor of anterior knee pain and recommend resurfacing in patients with BMI of more tan 30 mg/m2 or more tan 60 kg (28-29). The degree of chondromalacia found intra-operatively has also been used to decide patellar resurfacing. Some recent studies have show that there is no correlation between patellar chondral injury and anterior knee pain or re-operation rate (21-26). Actually there is no predictor to tell when to resurface the patella; however, we believe, like Antholz, that we should take into account the knee pain, the patient weight, the grade of condromalacia and the knee alignment (30).

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V. Conclusion

The current evidence regarding the TKA outcomes with or without patellar resurfacing is not conclusive. Based on the meta-analysis found in this review, surgeon may decide to routinely resurface the patella. However, the most recent RCT haven't got the same results. With this study we can say that in the current literature there is no agreement regarding if patella have to be or not resurfaced in primary TKA. Currently in the United States, more than 90% of PTRs have patellar replacement, while in Europe there is still no clear prevalence of surgical technique. Future research should focus on developing criteria for selecting those patients that would benefit from TKA without patellar resurfacing, and thus decreasing surgical complications.

So far the search for the "perfect" patellar component has not been achieved, leaving us a long way to go in the future of TKR. We must therefore continue working to identify the most appropriate patient for patellar replacement or to look for new alternatives that can settle this issue definitively and put an end to 40 years of controversy.

Our behaviour

Our behaviour is selective replacement, we believe that the management of the patella in TKA should be determined from case to case according to pre-operative parameters as BMI, age, anterior knee pain, knee alignment and intraoperative parameters as articular cartilage conditions. Actually in our practice and due to our patient's type, patellar replacement is realized in 90% of cases.

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