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ORIGINAL PAPER

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Comparison of two total knee prostheses on the incidence of patella clunk syndrome

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Abstract The patella clunk syndrome is not an uncommon complication, particularly after posterior-stabilized (PS) total knee arthroplasty. The present study was a consecutive unselected series comparing the incidence of the patella clunk syndrome amongst two comparable groups of elderly patients with knee arthritis implanted with the Insall-Burstein (IB II) total knee system and the newer NexGen Legacy total knee prosthesis. While 7.5% of patients in the PS IB II group developed patella clunk syndrome, none occurred in the NexGen group (P=0.05). We believe the difference is due mainly to a change in the design of the prosthesis, especially the more posterior intercondylar box and femoral cam of the NexGen femoral component.

Résumé Le ressaut patellaire audible (clunk syndrome) n'est pas une complication rare en particulier après arthroplastie total du genou postéro – stabilisée (PS). La présente étude est celle d'une série consécutive de patients non sélectionnés comparant la fréquence de ce syndrome parmi deux groupes comparables de malades âgés avec arthrose du genou traités par prothèse de Insall-Bustein (IB II) ou par prothèse NexGen Legacy. Pendant que 7.5% de malades avaient un «clunk syndrome» dans le groupe IB II, aucun ne s'est produit dans le groupe NexGen (P=0.05). Nous croyons que la différence est principalement due à un changement dans le dessin de la prothèse, notamment un boitier intercondylien et une came fémorale plus postérieurs pour la prothèse Nexgen.

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Introduction

Patella clunk syndrome is a syndrome of patellofemoral dysfunction, consisting of painful catching, grinding, or jumping of the patella on knee extension, and is a well-recognized complication after total knee arthroplasty [5]. The syndrome arises from an intraarticular fibrous nodule at the junction between the patella superior pole and the undersurface of the quadriceps tendon, the nodule being wedged into the intercondylar notch during flexion and dislodged on extension. A more recently described intraarticular fibrous band syndrome [10] may also potentially cause a similar painful audible clunk.

The patella clunk syndrome has mainly [7], but not exclusively, been associated with posterior-stabilized (PS) total knee system, whether or not the patella was resurfaced [8]. Hypotheses to explain the syndrome include the design of the intercondylar box [1], proximity of placement of the patella button wherein there is impingement of the patella prosthesis itself on the quadriceps tendon [5], and lack of adequate synovial tissue débridement at the junction between the quadriceps tendon and the patella superior pole.

Time lapse before occurrence of the patella clunk after implantation has been mostly 3–9 months, and sometimes 12 months [1]. We hypothesized that newer design changes in the NexGen total knee prosthesis would decrease the incidence of patella clunk syndrome when compared to the Insall-Burstein II (IB II) prosthesis that has been reported to be associated with this syndrome. We switched to this newer prosthesis at our hospital in 1999. Accordingly, we performed a retrospective study to compare our patients fitted with the IB II posterior-stabilized (PS) prosthesis implanted between late 1996 and 1998 to a group fitted with the NexGen Legacy PS total knee prosthesis implanted between 1999 and 2000. This was a consecutive, nonselected series of patients; we excluded only those cases that represented revision referred from other institutions or the private sector and not primary total knee arthroplasty.

Table 1 Data on patients with patella clunk syndrome

Patient	Age/ sex	Side affected	Etiology	Implant	Procedure	Post-op follow-up
1	M/62	Rt	Degenerative	IB II (PS)	Arthroscopic débridement	12 months
2	M/71	Lt	Degenerative	IB II (PS)	Arthroscopic débridement	25 months
3	M/65	Rt	Degenerative	IB II (PS)	Arthroscopic débridement	30 months
4	F/69	Rt	Degenerative	IB II (PS)	Open arthrotomy	35 months
5	F/73	Lt	Degenerative	IB II (PS)	Arthroscopic débridement	43 months
6	F/74	Lt	Degenerative	IB II (PS)	Refused operation	Not applicable

Materials and methods

Our study population consisted of 72 consecutive patients with 80 IB II total knee arthroplasties implanted between 1996 and 1998, and 42 consecutive patients with 50 NexGen total knee arthroplasties performed between 1999 and 2000. All were primary total knee arthroplasties and all implants were cemented. The patella was resurfaced in every patient. We ascertained it was an unselected series by assigning a staff blinded to the details of this study to obtain information of the consecutive arthroplasties from the logs of the operating room and excluded only revision cases referred from other centers.

The male:female ratio was comparable in the two groups, being 1:4.3 in the former and 1:4 in the latter. The mean age of the PS IB II group was 66 years (range 56–77), while the mean age of the NexGen group was 68 years (range 60–79). Primary degenerative arthritis was the etiology in 96% and 94% patients, respectively, the rest being rheumatoid knees with secondary degenerative arthritis. The same team of surgeons was involved in operating on the patients in both groups.

The diagnosis of patella clunk syndrome was based on clinical examination. The typical clunk was usually so obvious it could be heard or seen across the examining room. All patients with patella clunk were analyzed with respect to their age and sex distribution, side of the knee affected, mean time interval between index operation and occurrence of patella clunk, as well as knee alignment and sizes of components implanted. The pre- and postoperative Knee Society scores [6], as well as a clinical scoring of patellofemoral articulation after Insall and Stern [9], were recorded. In the latter system a score of 0 meant no symptoms, grade 1 was assessed as anterior knee pain perceived on climbing stairs, and grade 2 by moderate to severe pain on arising from a chair or pain that limited stair-climbing in a nonreciprocal fashion.

All patella clunk patients had comprehensive radiological assessment according to the recommendation of the Knee Society [3]. We took pre- and serial postoperative radiographs, including standing scanograms, true lateral radiographs, and Merchant's views, to assess the overall tibiofemoral alignment and the position and placement of the patella button. The assessment of the axial patellofemoral position was after Bindelglass and Vince [2], and the method of joint line measurement was after Figgie [4]. Only a brief period of conservative treatment was employed since past results of conservative treatment were disappointing [1]. Treatment was an average of 4 months in quadriceps training with no steroid injection. We preferred arthroscopic débridement to open arthrotomy unless we envisaged the need for component revision or concomitant soft-tissue realignment procedures for the extensor mechanism. All patients after surgery for patella clunk had close follow-up to check for possible recurrences. The difference in incidence of patella clunk syndrome among the two group of patients was subjected to statistical analysis by the use of Chi-Square test.

Results

There were a total of six patients with patella clunk, all belonging to the PS IB II group. They consisted of four women and two men, with the right and left side affected with equal frequency. The mean age was 69 years (range 62–74), and the mean time from the index operation to the development of patella clunk was 6 months (range 3–10 months). Details of demographic data of the "clunk population" are shown in Table 1. The mean pre- and postoperative patella thicknesses were 22 mm (range 19–25 mm) and 23 mm (range 21–24 mm), respectively. The patella button was centrally located in all six patients, and there was no proximal placement of the patella component nor patella baja. On the Merchant's view one patella was found to be tilted laterally, but there was no subluxation or dislocation of the extensor mechanism. There was no evidence of significant upsizing or downsizing of the distal femur judging from the anterior, posterior, and summated femoral heights measured, and all the tibial components appeared in good position.

Preoperatively, four knees were varus, averaging 12° (range 8–19°), and one was neutral. The Q angle and limb alignments were normalized postoperatively. Four patients underwent arthroscopic débridement and one had an open arthrotomy for excision of the fibrous nodule and an open lateral release. None of the operated patients required any component revision or soft tissue realignment procedures. The remaining patient refused operative intervention.

Knee Society scores improved in the five operated patients from a mean value of 65 preoperatively (range 60–75) to 90 postoperatively (range 80–100). The clinical score of the function of the patellofemoral articulation was grade II in three knees and grade I in two knees preoperatively. All five patients who had surgery had a score of grade 0 postoperatively and were symptom free. Mean preoperative flexion range of the five operated patients was 105° (range 100–110°) while the mean postoperative knee flexion range was 116° (range 108–120°). The average length of follow-up was 29 months (range 12-43). No recurrence of patella clunk was detected in any of the five operated patients at the latest follow up, and no patient was lost to follow-up. Analysis by the Chi-Square method to check whether the difference in incidence of patella clunk syndrome was statistically significant among the two patient populations revealed a P value of 0.05. Thus, the incidence of 7.5% of the IB II PS group having patella clunk as compared to 0% in the NexGen group was found to be statistically significant.

Discussion

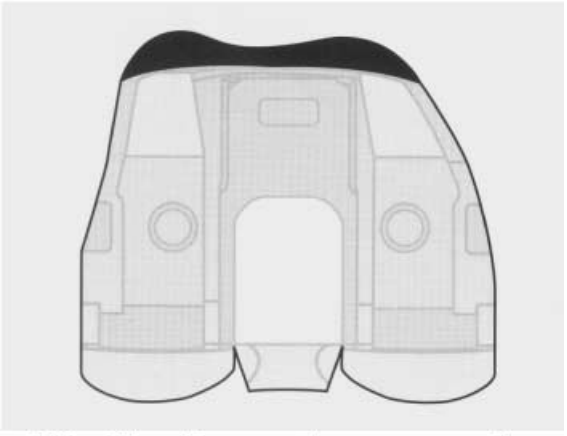
The fact that the design of a total knee system has a strong bearing on the occurrence of patella clunk syndrome is best seen in previous large-scale studies comparing PS total

(IB II Femoral Component)

(NexGen Femoral Component)

Fig. 1 Comparison of the femoral component design (sagittal view)

(IB II Femoral component)



(NexGen Femoral component)

Fig. 2 Comparison of the overall design and position of the intercondylar box

knee system with a system where the femoral component had the same geometry as the traditional "total condylar prosthesis" – patella clunk being uniformly absent in the latter group [8]. It is also worthy of note that, although patella clunk syndrome mainly occurs in PS total knee system, the frequency of occurrence differs markedly with different PS designs. Thus, it is rare in some PS knee systems, such as the Genesis II knee, where the relative posterior location of the intercondylar box is a by-product of its bone-sparing feature of the intercondylar cut. As regards the new design features (Figs. 1, 2, and 3) of the NexGen Legacy PS knee prosthesis, they include (1) a raised lateral flange of the femoral component and a deepened trochlea groove, thus creating a more anatomic design of the trochlea articulating surface, as evidenced by the specially designed right and left femoral components that may help reduce the incidence of postoperative patellofemoral symptoms; (2) the relative position and the design of the intercondylar box itself, including the spine–cam interaction, had changed. The NexGen Legacy's spine–cam interaction has a similar pathway and angle of contact as the older designs; however, the femoral cam is positioned further posterior and proximal in the NexGen Legacy's femoral component. The posterior translation of the cam-and-post mechanism is the result of the redesign of the trochlea to accommodate the natural patella. It is this more posteriorly situated intercondylar box that we think contributes most to the lack of patella clunk syndrome since the chance of soft tissue entrapment on knee flexion is lessened (Fig. 2). In addition, this design may increase stability by allowing the femoral cam to ride down the post (instead of riding up, as in most previous PS designs) prior to eventually moving up the post with extreme flexion. This may effectively increase the "jump distance" and allow greater flexion prior to dislocation.

As far as the role of débridement of synovium at the junction of the quadriceps tendon and patella is concerned, we do not think this issue of adequacy of synovial tissue debridement has a strong bearing on the incidence of patella clunk in this study, since meticulous clearing of the synovial tissue at the junction was exercised – especially between the quadriceps tendon and the patella – in both groups of patients,. In addition, as there was no evidence of proximal placement of the patella component in

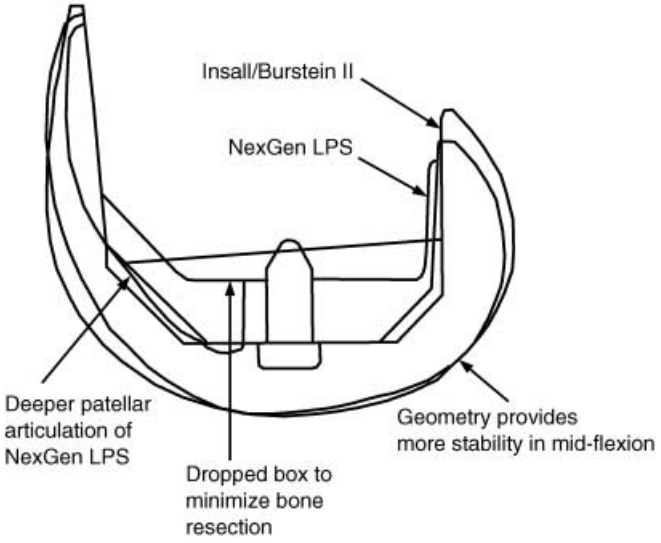


Fig. 3 Comparison of sagittal profile of the femoral component

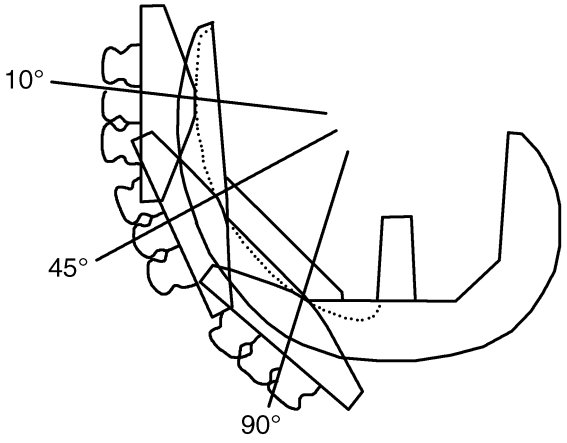


Fig. 4 Schematic diagram illustrating the different position of the patella button with different knee flexion range

either group of patients, we do not think this factor plays an important role in the pathogenesis of patella clunks in the current study.

Finally, the reason patella clunk syndrome does not occur in every patient implanted with the PS IB II total knee implant is not completely understood. It is highly likely that a combination of factors has to occur in order for patella clunk syndrome to be produced, or, in other words, multifactorial – a point initially suggested by Hozack [5] who first coined the term patella clunk syndrome. Although we know that the design of the total knee prosthesis plays a key role, as mentioned in the aforesaid discussion, the final production of patella clunk syndrome depends on many factors. These factors are the initiation of scarring near the junction of the superior pole of the patella button and the adjoining quadriceps tendon; attainment of a critical size by the fibrous nodule before symptoms occur; adequacy of clearance of the synovium during the index operation; and range of motion attained after the operation, since a reasonably good range of motion of nearly 90° or more must be achieved before the superior pole of the patella (where the fibrogranulation tissue is located) comes into contact with the intercondylar box and allow soft tissue entrapment. This explains why the patella clunk syndrome seldom occurs in knees with poor flexion range after a PS IB II replacement. This also explains the interesting observation in previous studies [1, 10] that diminished knee motion is not associated with this complication, unlike other complications of total knee arthroplasty [1]. The same phenomenon of good postoperative knee flexion range was found in the patients with patella clunk in this study. An illustration of the correlation of the different position of the patella button with different knee flexion range, and hence the different distances from the intercondylar box, is shown in Fig. 4.

The lack of patella clunk syndrome in patients treated with the NexGen Legacy total knee system appears promising. The difference in incidence of patella clunk syndrome in these two groups of elderly patients with comparable demographics was statistically significant, and we believe it is also clinically significant. An ongoing study in this department includes future comparison of a population with the two different prostheses implanted on both knees of the same patient. This will be feasible since 70% of our PS IB II group of patients are still awaiting total knee replacement for the opposite knee. Finally, we believe the observed lack of patella clunk syndrome to be due mainly to a more posterior intercondylar box and femoral cam of the femoral component in the newer NexGen Legacy total knee system.

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