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Dislocation of the polyethylene insert following fixed-bearing total knee arthroplasty: A case report

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Abstract
Dislocation of the polyethylene liner is a rare complication of fixed-bearing total knee arthroplasty with only a few cases described in the literature. This case report describes a 62 year old gentleman with previous total knee arthroplasty (TKA) using a cemented Physica posterior stabilised implant who experienced an anterior dislocation of the polyethylene liner after a fall causing hyperflexion. This is to the best of our knowledge the first case in literature that describes sudden dislocation of the polyethylene liner following traumatic injury.

Keywords: Knee arthroplasty, dislocation, fixed bearing

Introduction
Total knee arthroplasty (TKA) is a commonly performed orthopaedic operation and is shown to have excellent longevity and patient satisfaction [1]. There are many complications associated with TKA described in the literature such as post-operative infection and stiffness, periprosthetic fracture and polyethylene insert wear over time [1, 2]. Dislocation of the polyethylene insert is a very rare and easily missed complication with only a few cases described in the literature. The majority of these cases are atraumatic in nature with no clear cause found whilst one case was secondary to a prosthetic joint infection [3]. This report aims to describe what we believe to be the first case of sudden dislocation of the polyethylene liner following traumatic injury. We review the proposed mechanisms of dislocation outlined by previous authors and highlight how our case is likely the result of excessive posterior loading during hyperflexion injury causing dislocation.

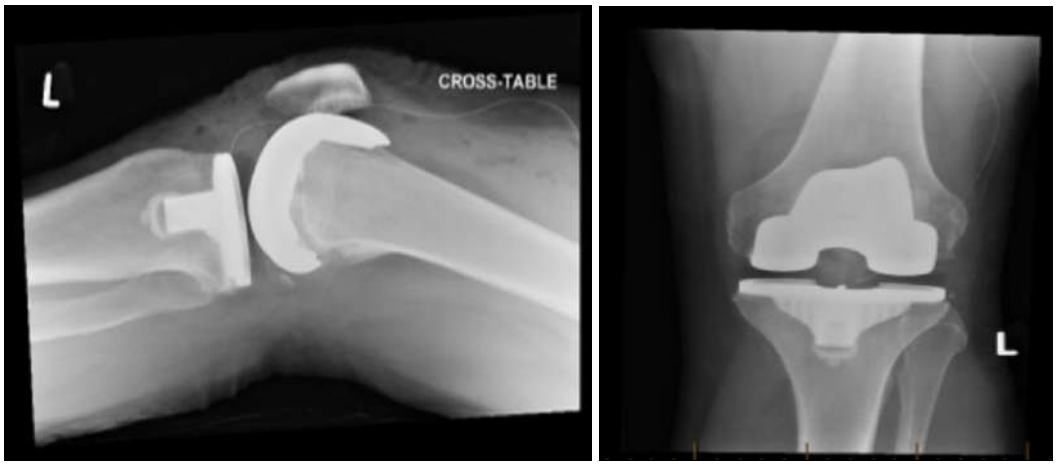
Case
This case involves a 62 year old gentleman who suffered from left knee osteoarthritis subsequent to a football injury dating back to 1980. He initially coped well following a meniscectomy. However, he developed progressive increased pain over the course of five years which limited his ability to perform his activities of daily living. He subsequently underwent a TKA in 2018 using a Physica posterior stabilised (PS) system with a size 9 cemented tibia component, size 8 cemented femoral component, size 9 #12 tibia PS liner and a 35mm x 8.5mm cemented patellar prosthesis [Figure 1]. His intraoperative knee range of motion on table was 0-150 degrees with stability achieved throughout the entire range and the polyethylene implant was securely fixed to the tibial tray without soft tissue, bone or cement interference. His postoperative recovery was unremarkable.
Three months after his TKA he fell on the stairs at a concert leading to a hyperflexion injury where he “felt something go” inside his knee. Following this his knee became completely unstable and x-ray imaging showed dislocation of his polyethylene liner [Figure 2]. He was taken to the operating theatre and a clearly dislocated liner was identified. Macroscopically there was deformation of the medial trough, seemingly normal posterior grooves and a smaller anterior groove for the locking mechanism. There was no evidence of soft tissue or cement on the tibial tray and the tray itself appeared normal. The anterior flange measured 18.46mm wide, 2.02mm high and 0.8mm deep [Figure 3]. Upsizing of the trial revealed a lack of extension and so a new size 9 #12 PS liner was reinserted. This again displayed good stability throughout the entire range of motion. He had an unremarkable post-operative recovery and two years down the line is able to achieve 0-140^{o} motion with no concerns [Figure 4].

Discussion

Dislocation of the polyethylene liner of a fixed TKA is rare. There have been a few cases reported in the literature of spontaneous dislocation, however no clear cause has been identified. The most popular opinion is that repeated posterior compressive forces can cause lift off of the anterior rim overtime leading to spontaneous dislocation [2-6]. From a biomechanical perspective, flexion movements particularly when starting from full extension cause greater posterior load as tibial-femoral contact moves in a posterior direction leading to force applied in an antero-superior direction. If there is failure of the locking mechanism due to wear and tear or overt failure, or the insert was not implanted correctly at the time of surgery, then this force can lead to anterior lift off and thus anterior dislocation [3, 6]. Kobayashi and colleagues showed this clearly in a model whereby they destroyed the locking mechanism with a bone saw. They found that when the femoral component was located slightly posteriorly compared to the insert anterior lift off and dislocation occurred with minimal flexion. They hypothesised that this trivial mismatch can occur in a variety of instances, such as when getting up from the supine position, as was seen in their case report, or walking down stairs [6]. Some authors describe cases where they believed ligament laxity contributed to wear and tear of the locking mechanism in a similar mismatch scenario to the model described by Kobayashi and colleagues [7]. Rutten and colleagues proposed that impingement on soft tissue structures or osteophytes by the insert can lead to disruption of its positioning and a susceptibility towards spontaneous dislocation [8].

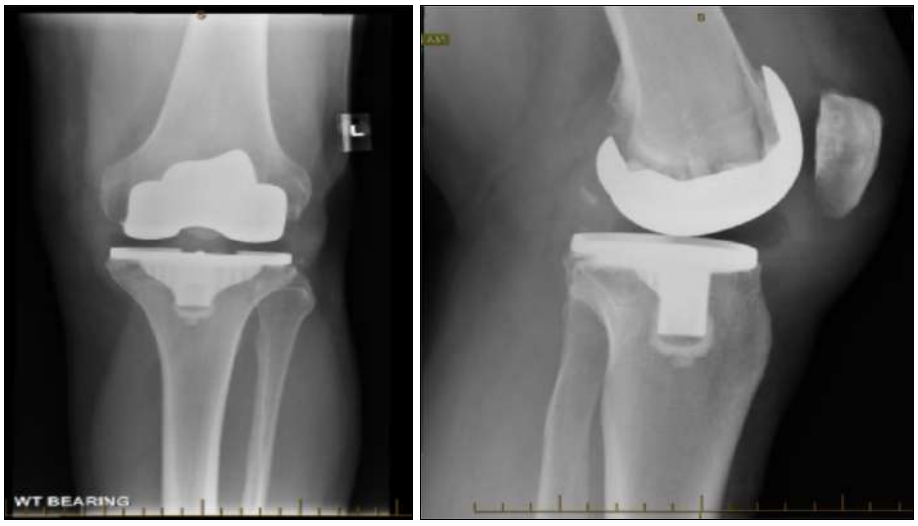
It is of our opinion that our patient had significant enough posterior load during his hyperflexion injury to lift off the anterior rim causing sudden dislocation of the liner. In this case we checked at the time of initial surgery that the liner was seated properly, post-operative x-ray imaging showed normal positioning and he was symptom free until his injury. Furthermore, at revision there was no bone, soft tissue or cement identified that could have impinged on the tibial tray. Therefore we believe dislocation occurred in the setting of a normal, well positioned liner. In this case we postulate that the large, size 9 implant, coupled with the small anterior flange of the Physica implant design predisposed to anterior dislocation from excessive posterior force experienced during a fall causing hyperflexion and loading of the knee.

In cases of dislocation revision surgery is recommended. In our patient, replacement of the liner alone provided good results however some reports of spontaneous dislocation have shown an association with weakening of the locking system [5]. In these cases revision of the tibial component as well as the liner is indicated.



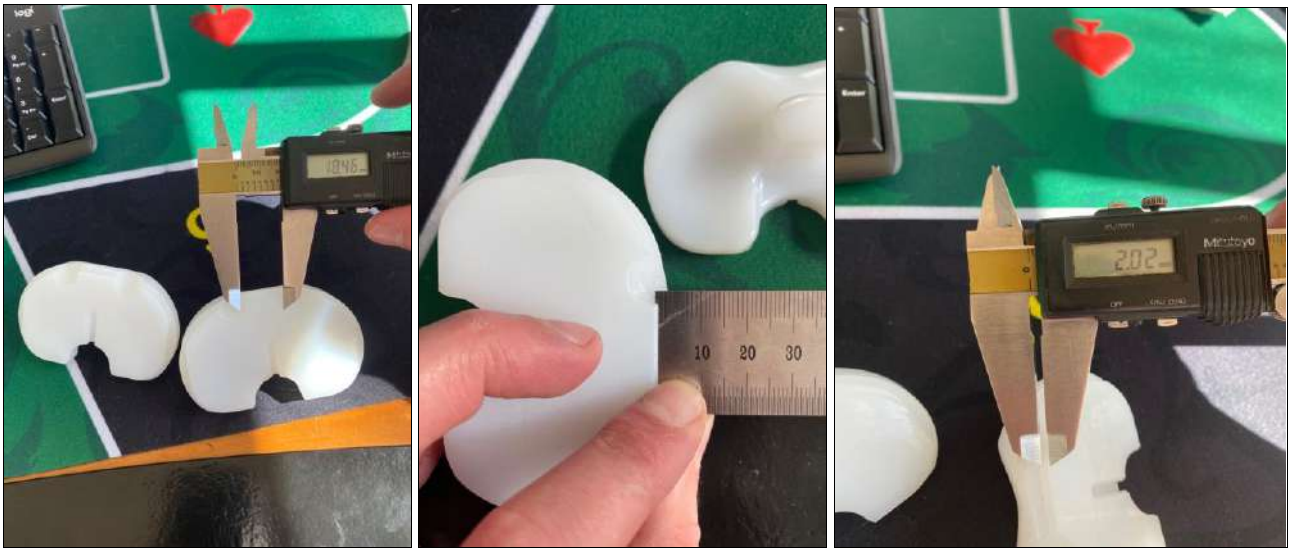
A. B.

Fig 1: Radiographs in cross-table and anterior views after the initial TKA showing a well located polyethylene liner



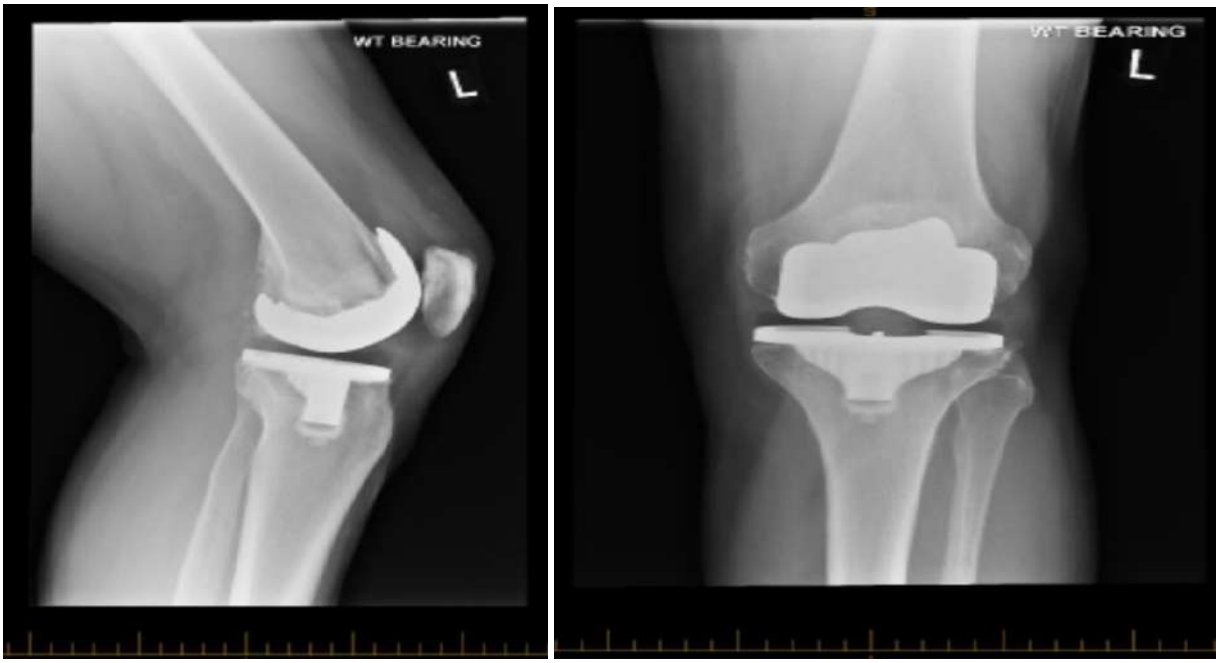
A. B.

Fig 2: Radiographs in lateral and anterior views showing anterior dislocation of the polyethylene liner



A. B. C.

Fig 3: Photographs post-operatively showing dimensions of the anterior flange of the polyethylene insert.



A. B.

Fig 4: Post-revision radiographs in lateral and anterior views showing a well located polyethylene liner.

Conflict of Interest/Competing Interests: All authors declare no conflicts of interest or competing interests.

Ethics: As this was a case report, IRB approval was sought but deemed unnecessary as the single patient consented (and continues to consent) to their involvement, negating the need for review board approval.

Author Contributions: Conception or design of work: CAF and DCK. Acquisition, analysis, or interpretation of data for the work: CAF and DCK. Drafting of work or revising it critically for important intellectual content: CAF and DCK. Final approval of version to be published: CAF and DCK.

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

All data generated or analysed during this study are included in this article [and/or] its supplementary material files. Further enquiries can be directed to the corresponding author.

Conclusion

We hope with this case to illustrate traumatic polyethylene liner dislocation as a possible, albeit rare, complication of TKA. We believe our case was secondary to excessive posterior load during a traumatic injury in a large fixed bearing implant with a small anterior locking flange.

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