MODULAR Tibial COMPONENTS IN TOTAL KNEE ARTHROPLASTY: DO THEY HAVE A FUTURE?

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Introduction

The wear of ultra high molecular weight polyethylene (UHMWPE) in Total Knee Arthroplasty (TKA) is one factor influencing the performance of implants in vivo. Wear particles produced by artificial joints are suggested to be responsible for causing osteolysis, resulting in implant failure [1,2,3]. It was found that relative motion occurs between the tibial tray and the polyethylene inserts and it is suggested that this causes fretting wear. Slack of the capture mechanism is proposed to be the main cause for this relative motion [2,3]. Wasielewski et al. suggested that the tibial tray be polished to decrease the severity of wear [3]. The purpose of the present study was to determine if polished tibial trays effectively reduced the problem of backside damage.

Methods

One series of 11 retrieved AMK (Depuy) and a series of 20 Genesis II (Smith+Nephew) tibial inserts were used in the present study. The time in vivo was 34 months (range 1 – 66) for the AMK and 9 months (range 1 – 23) for the Genesis II implants. In all cases, the reason for primary joint replacement was osteoarthritis. Each implant was cemented and had a polished tibial base plate without screw holes. The reasons for revision of the AMK implants were polyethylene wear (2), instability and dislocation (5), infection (2) and idiopathic pain (2). The reasons for revision of the Genesis II were infection (16), instability (2) and idiopathic pain (2).

The backsides of the tibial inserts were divided into six equally-spaced zones. The method introduced by Hood et al. [5] and modified by Collier [7] was applied to the backside surface to assess damage type and severity. The specimens were graded by two independent observers under 10-40X magnification using an optical microscope. Following gold coating (by sputtering), surface features were characterized using scanning electron microscopy under low accelerating voltage (5 kV).

Results

Backside damage was observed on all specimens (Fig.1) but there were no cases of catastrophic failure. The most frequent feature of wear was burningish, located predominantly on the periphery of the implants. Scratching, abrasion, deformation and pitting were also observed, while cracking and delamination were absent. Chi-square tests revealed that there was no difference in the severity of wear medially and laterally for the AMK (p=0.243) and Genesis II (p=0.421) inserts. Both models exhibited a similar trend of increased wear score with increased time in vivo.

A typical image (Fig. 2) showed burnishing, scratching and abrasion in one region. Observed microdamage (Fig. 3) included ripples (aligned rows of nodules) and dispersed smeared nodules. Submicron pulled-out fibrils were also present.

Discussion

Even with polished tibial trays, backside wear still occurred in total knee replacements. The surface features (Fig.3) suggested the generation of submicron particles which could lead to macrophage induced osteolysis and result in failure of the implant [8,9].

It would appear that polyethylene locking mechanisms found in modular tibial components still allow some micromotion thus permitting backside wear to occur even with polished tibial tray. The findings of this study suggest that a return to all-polyethylene or non-modular tibial components may solve the problem of backside wear.

References