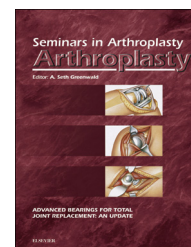


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The stiff total knee replacement: Evaluation and treatment

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ABSTRACT

Stiffness after TKR is a frustrating complication that has many possible causes. Though the definition of stiffness has changed over the years, most would agree that knee flexion of less than 75° and a 15° lack of extension constitutes stiffness. This presentation will focus on the potential causes of a stiff TKR, intraoperative tips to avoid this outcome, the postoperative evaluation and management, and the results of revision for a stiff TKR. The management of this potentially unsatisfying situation begins preoperatively with guidance of the patient's expectations; it is well known that preoperative stiffness is strongly correlated with postoperative lack of motion. At the time of surgery, osteophytes must be removed and the components properly sized and aligned in all planes. Flexion/extension gaps must be equalized and soft-tissue balancing must be attained. One must avoid overstuffing the tibiofemoral and/or patellofemoral compartments with an inadequate bone resection. Despite these surgical measures and adequate pain control and rehabilitation, certain patients will continue to frustrate our best efforts. These patients likely have a biological predisposition for formation of scar tissue. Other potential causes for the stiff TKR include complex regional pain syndrome or joint infection. Close follow-up of a patient's progress is crucial for the success in return of ROM. Should motion plateau early in the recovery phase, the patient should be evaluated for manipulation under anesthesia. At our institution, most manipulations are performed within 3 months postop under an epidural anesthetic; on occasion, patients will stay overnight for continuous epidural pain relief and immediate aggressive PT. The results of re-operations for a stiff TKR are variable due to the multiple etiologies. A patient with arthrofibrosis with a clear cause of stiffness, such as component malposition, malrotation, or overstuffing of the joint, has a greater chance of regaining motion than arthrofibrosis without a clear cause. Although surgical treatment with open arthrolysis, isolated component, or complete revision can be used to improve TKR motion, results have been variable and additional procedures are often necessary.

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1. Introduction

Stiffness is one of the most common complications following TKR, causing frustration to both the surgeon and the patient. Pariente et al. [1] examined their experience between 1997 and 2003, including over 5000 TKRs, and found that

approximately 7% of them met their definition of stiffness. Of this 7%, 75% underwent successful manipulation under anesthesia; however, 15% of knees undergoing manipulation remained stiff and subsequently required revision surgery. Thus, 1% of these primary TKRs experienced stiffness to the degree that revision surgery was necessary.

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Table 1 – Average Change in Postoperative Knee Range of Motion Using a Cruciate-Retaining Knee Replacement, Stratified by Preoperative Knee Flexion

Preop Flexion	Δ ROM From TKR
<80°	+ 27°
81–102°	+ 12°
103–115°	+ 3°
116–122°	–3.3°
>123°	–10.8°

Similarly, Yercan et al. [2] examined over 1100 TKRs and found a 5.3% rate of stiffness. Of the patients having manipulation, approximately 20% failed and required revision surgery, again giving a 1% incidence of revision.

2. Definition of stiffness

The flexion requirements for certain activities of daily living have been well documented [3,4]. It is interesting to note how the definition of stiffness has changed over time. In 1990, Nicholls and Dorr [5] defined stiffness after TKR as flexion <45° and a flexion contracture of 20°. In 2002, Christensen [6] defined stiffness as a flexion of less than 75°. In 2006, Yercan [2] defined the stiff knee as one that flexed less than 95° and had a flexion contracture of 10°. Therefore, the literature reflects that both surgeons and patients have greater expectations for their knee replacements today than 20 years ago [7].

3. Functional limitations

The disability of walking with a flexion contracture has been well researched [8]. Walking with a flexed-knee gait requires constant quadriceps activation, leading to an increased energy consumption and greater fatigue. Without sufficient flexion, activities of daily living such as stair climbing, rising from a chair, and tying one's own shoelaces can be quite challenging. Although the traditional teaching is that a stiff knee should not be painful, patients who are fighting a non-functional range of motion will have pain during these activities.

We believe that the disability from a lack of full extension is much greater than from a lack of flexion. Thus, it is extremely important to monitor the ability to fully extend the knee both intraoperatively and postoperatively. Furthermore, we are more likely to intervene surgically if the patient has a flexion contracture due to the presence of a limp and difficulty in walking [7], as opposed to operating for a lack of flexion.

4. Causes

The etiology of stiffness after TKR is multifactorial and can be divided into preoperative, intraoperative, postoperative, and patient factors.

4.1. Preoperative

It has been well documented that preoperative range of motion is the best predictor of postoperative range of motion

[9,10]. Thus, the treatment of stiffness after TKR must begin with the management of patient's expectations. In other words, a surgeon must counsel a patient preoperatively about their expected motion gain or loss following TKR. Most patients will gain approximately 10°–15° of motion from TKR; however, some hyperflexible patients will lose motion. By looking at the bell-shaped curve of preoperative ROM, we can observe that the postoperative curve will not only shift to a greater mean ROM, but also be with a smaller standard deviation. Patients beginning with greater preop ROM may therefore lose motion postoperatively. Berend [11] presented data for a cruciate-retaining knee that demonstrated an average postoperative ROM of approximately 115° (Table 1). By examining patients with regard to their preoperative ROM, the average gain/loss of ROM postoperatively can be calculated, allowing for the management of expectations.

A history of prior surgery, particularly a high tibial osteotomy, and the diagnosis of post-traumatic osteoarthritis has also been associated with stiffness post-TKR. Therefore, these patients should be aware in advance that there is a greater incidence of postoperative stiffness when compared to a virgin osteoarthritic knee.

4.2. Intraoperative

Since these are the factors under a surgeon's control, these are the parameters to which we must pay the most attention. Meticulous surgical technique is critical for the realization of good motion. A surgeon must position the implants properly with regard to the coronal and sagittal planes. The goal of tibial resection is to produce a cut bony surface perpendicular to the mechanical axis, with a few degrees off posterior slope. The aim of femoral resection is to recreate neutral mechanical limb alignment with 3°–6° valgus and 0°–4° of flexion. Figure 1 demonstrates a femoral component placed in excessive flexion, thereby limiting extension. The position of the implants relative to the joint line is also important. In general, the amount of bone removed must equal the



Figure 1 – Femoral component placed in excessive flexion, leading to a lack of extension.

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