Chapter 11
LCS® Multicenter Worldwide Outcome Study

11.1 The LCS Clinical Experience – An Overview of the Literature

J.B. Stiehl

Introduction

Mobile bearings were originally introduced with the Oxford knee in 1977 which sought to improve articular congruity for improved wear characteristics using a spherical, congruous articulation while diminishing implant constraint with a floating surface [6]. The Low Contact Stress (LCS) knee prosthesis (Depuy, Warsaw), the subject of this outcome study was a mobile bearing design with modifications of the tibial component to allow for posterior cruciate retention (meniscal bearing) or sacrifice (rotating platform). From the outset, it was recognized that a long term experience would be needed to prove the experiment that mobile bearings would solve the issues of fixation and wear through a favorable, high area of contact, wear surface and nonconstrained movable bearings [2].

An interesting point of comparison with other fixed bearing prosthetic designs is the fact that over the years, the LCS components have remained identical in geometry from the outset of original implantation in 1977. In contrast, most implant systems have undergone substantial design changes over a period of time, thus adding complexity to any conclusions about potential long term durability. With keen interest of current prosthetic designers in the mobile bearing concept, it is important to evaluate these implants over the long term to determine which factors may predispose to late clinical failure.

This chapter will present the existing knowledge on the clinical efficacy of the LCS total knee system. We will evaluate peer reviewed publications regarding the LCS prosthesis analyzing the long term outcome and clinical performance of the femorotibial articulation, patellar resurfacing, and various issues of surgical technique such as cruciate retention or sacrifice, tibial axis alignment method of bone resection, cement versus cementless, and the lateral approach in valgus deformed knees. These results will be compared with outcome studies of total knee arthroplasty in general. We will then present the results of a multicenter outcome study evaluating the survivorship results from surgeons around the world who have extensive experience with the LCS knee.

LCS Clinical Experience (Literature Review)

Buechel and Pappas presented their 10 year experience with the LCS knee replacement of the first 357 total knee arthroplasties in 1989 [3]. There were 72 bicruciate retaining meniscal bearing implants, 49 posterior cruciate retaining meniscal bearing implants, and 137 posterior cruciate sacrificing rotating platform implants, with 80 revision arthroplasties. Of the entire group, there were 231 excellent results and 87 good results with 89% of the total in these categories and the remaining in fair or poor categories. In regards to complications specific to mobile bearings, there were 7 rotating platform dislocations (3.2%) and 1 traumatic meniscal bearing dislocation (0.7%). Most of the revision arthroplasties were re-revision of difficult revision cases where there was flexion instability. Factors predisposing to mobile bearing complications such as dislocation were stated to be malrotation of the tibial component allowing a meniscal bearing to sublux, late rupture of the posterior cruciate ligament, flexion/extension gap instability, and traumatic twisting of the knee joint. Three tibial components loosened (2.0%) in very heavy patients where the component poorly covered the proximal tibia. There were no femoral implant loosenings.

Buechel et al. reported their 11 year experience with the LCS metal-backed, rotating-bearing patellar prosthesis in 515 total knees of which 331 had greater than 24 month follow-up [4]. The overall postoperative fracture rate was 0.58% with avascular necrosis seen in 0.38%. There was one patellar dislocation of the entire group and no polyethylene dissociations, no polyethylene wear through and no implant loosenings. It was postulated that the deep femoral groove engagement prevented dislocation and allowed high contact, even with subluxation.
Buechel et al. studied 373 LCS total knee replacements of their initial series surviving a minimum of 10 years [1]. Of this group, 97.9% had good or excellent results with the posterior cruciate retaining meniscal bearing implant, 100% with the cemented rotating platform, and 97.9% with the cementless rotating platform. Meniscal bearing dislocation occurred in 2.5% while 5% required meniscal bearing exchange for wear at an average of 10.1 years. Rotating bearing dislocation was seen in 1.2% and there were three rotating platforms revised for wear of the overall group. Kaplan-Meier survivorship for non-infected LCS total knee replacements and mechanical loosening for any reason was 83% at 16 years for the cementless meniscal bearing group, 97.7% for the cemented rotating platform group, and 98.3% at 18 years for the cementless rotating platform group.

Stiehl et al. reported the results of the American FDA clinical trial in 147 meniscal bearing and 44 rotating platform total knees done with a cementless technique at an average of 68 months follow-up [10]. Pain was absent in 94% of meniscal bearing and 93.2% of the rotating platform knees. Range of motion averaged 120° for the meniscal bearing and 180° for the rotating platform knees (p<.001). The overall New Jersey Orthopedic Score was 93.2 for the meniscal bearing knees and 87.6 for the rotating platform knees (p<.001). The overall survivorship was 98.1% at 7 years. The overall meniscal bearing complication rate was 0.6% with one fracture and one extrusion. No rotating platform problems bearing spinouts were noted. The patellar complication rate was 1%.

Jordan et al. evaluated 473 cementless cruciate retaining meniscal bearing LCS total knees with 2–10 year follow-up (average 5 years) [7]. Mechanical failure occurred in 3.6% with meniscal bearing fracture and dislocation in 2.5%. In 1%, there was tibial subluxation resulting from ligamentous instability. Kaplan-Meier survivorship for mechanical revision for any reason was 94.6% at 8 years.

Sorrels reported the results of 525 cementless rotating platform total knees with up to 13 years follow-up [11]. The revision rate of this entire group was 5%, and tibial component exchange rate for polyethylene wear or instability was 2%. The survivorship for mechanical component failure was 92.9% (95% CI: 83–100%) at 13 years. Sorrels et al. reported a subgroup of this experience with 117 patients younger than 65 years (average 56 years). With average follow-up of 8.5 years, the average knee score was 91 points and pain score was 27 (with a possible 30). The survivorship with revision for any reason was 88% at 14 years. The revision rate was 7% with four malpositioned implants, one infection, and one case of osteolysis. Bearing dislocation or “spin out” occurred in one case at three weeks following surgery.

Callaghan et al. studied 114 cemented LCS rotating platform total knees with 9–12 year follow-up [5]. The average Knee Society clinical and functional score was 90 and 75 at final follow-up. The average active range of motion was 102° at final follow-up. In this series, there were no cases of periprosthetic osteolysis, implant dislocation, or evidence of implant loosening and none of the patients available for follow-up have been revised.

Stiehl and Voorhorst evaluated factors affecting range of motion with the LCS total knee evaluating the posterior cruciate retaining or sacrificing technique in 782 total knees [12]. Postoperative motion averaged 115° for the meniscal bearing and 104° for the rotating platform (p<0.05) but the preoperative range was significantly lower for the rotating platform. The greatest gains in motion occurred in patients with less than 90° of preoperative motion and improvement in motion was greater in patients without prior surgery.

Klebish et al. compared LCS total knees with patella u-surfacing versus LCS total knees without u-surfacing.

Klebish et al. compared resurfaced LCS total knees versus non-resurfaced LCS total knees, in 52 patients with bilateral total knee arthroplasties with an average follow-up of 5.24 years [9]. Comparing the group overall, there was no significant difference with subjective preference, performance on stairs, or the incidence of anterior knee pain. However, they recommended non-resurfacing in cases with a small patella under 19 millimeters thickness or the younger active patient and resurfacing with the very large patella and in the workmen’s compensation case.

Klebish et al. reviewed their experience with the lateral parapatellar approach for the valgus deformed total knee arthroplasty in 53 patients who had undergone an LCS total knee arthroplasty [8]. The results were good/excellent in 94% of cases, and there were no failures from patellar maltracking or implant instability. They stated that a lateral release, which is needed in most of these cases, is part of the approach allowing the medial blood supply to be preserved. More recently, a coronal z-plasty has been recommended where the lateral retinacular dissection is more lateral in the superficial and then dissects medially through the synovium and fat pad allowing for a significant lateral based soft tissue mass that allows for a water tight lateral closure.

The clinical performance of the LCS total knee prosthesis remains exemplary based on long term clinical outcome studies. The incidence of bearing complications remains low, particularly with the posterior cruciate sacrificing rotating platform implant. Osteolysis and patellar problems are extremely low compared to the general total knee experience and can be cited as a primary reasons for favoring the LCS implant. Surgical