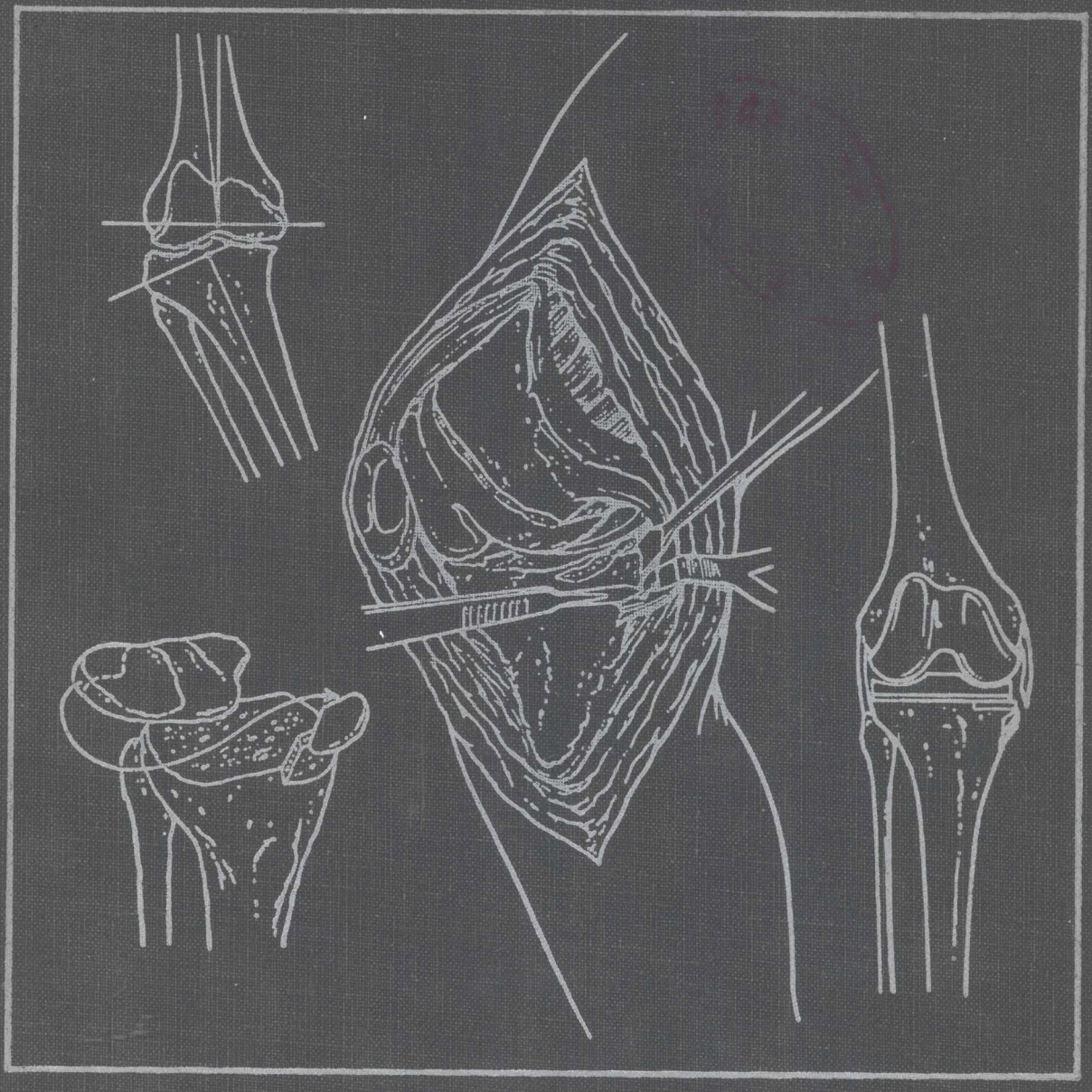
THE TECHNIQUE OF *Total Knee Arthroplasty*



KENNETH A. KRACKOW

THE TECHNIQUE OF
Total Knee Arthroplasty

KENNETH A. KRACKOW, M.D.

Associate Professor
Department of Orthopaedic Surgery
The Johns Hopkins University School of Medicine
Baltimore, Maryland

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Line and tone drawings by **Michael E. Leonard**
with **Lydia V. Kibiuk**

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THE TECHNIQUE OF Total Knee Arthroplasty

This volume is dedicated to my wife

Annamarie

whose idea it was to produce this book as an expansion of my work for an AAOS Instructional course and whose encouragement has helped bring it to fruition

and to the

Department of Orthopaedic Surgery

of The Johns Hopkins University

where I trained, and in which I have had the opportunity of gaining the experience and insight necessary for compiling this text

Preface

This volume might fairly be described as a "how-to" text. It is devoted in a broad sense to "how to perform" a primary total knee arthroplasty. Also involved are the "how-to's" of preoperative planning, patient selection, and postoperative management. It is appropriate as well to understand what this book is *not*. It is not intended to be an encyclopedic presentation of total knee arthroplasty. In particular, it does not deal with the management of specific complications such as infection, fractures, or extensor mechanism problems. It does not deal at all with revision of total knee arthroplasty, nor with general issues of biomechanics, kinematics, and anatomy of the knee.

This text is what I have come to believe an orthopaedic surgeon or resident in orthopaedics needs to know, in a relatively "immediate" sense, as he approaches a total knee arthroplasty. After approximately 10 years of practice, which have been devoted almost exclusively to arthroplasty and osteotomy of the knee and hip, and more than 6 years of intensive travel and lecturing on the topic of total knee arthroplasty, both in the United States and abroad, certain conclusions on this subject seem clear. Practicing orthopaedists and residents-in-training ask certain questions repeatedly. When I disucss their referral cases with them, there are background areas that commonly need enhancement and certain points that seem difficult for students to grasp. Also, as I observe "students of total knee arthroplasty" in the operating room, there are common aspects of intraoperative technique that frequently need attention.

I anticipate that even the experienced knee arthroplasty surgeon may find something of value in this book, since there are some techniques and analyses, that are original. In particular, I refer to the discussion of the interaction of rotational deformity, axial alignment, and compartmental overload; certain aspects of ligament reconstruction techniques; the rotational alignment pitfalls at the femur; and techniques of bone preparation and grafting on the tibia.

A portion of the material presented here can be found in printed form elsewhere, that is, one or several points might be made in one paper or other points in a larger text. The overriding purpose of this volume, however, is to bring this information together—including personal ideas, analyses and techniques—and to present all of these in an organized form that achieves the goal of supplying the background information of total knee arthroplasty.

In keeping with the stated purpose of providing such information to a large cross section of the orthopaedic community, there are certain issues and controversies that have specifically been avoided. This volume may be regarded as generic with respect to prosthesis selection across different brands. Many types are mentioned and are presented as examples. Their design features are not debated in terms of "worth," with the exception of some comments about highly constrained "hinge" units—comments that are widely accepted in this country. The

points of difference between minimally constrained three-ligament prostheses, slightly more constrained two-ligament ones, and the more constrained posterior stabilized units are presented and addressed but are not debated or otherwise handled in terms of overall propriety. No attempt has been made to undermine the prosthesis selection of those whose choices are significantly different from mine.

Controversy currently exists over the role of cemented versus uncemented arthroplasty and, for those interested in uncemented arthroplasty, controversies exist regarding porous coatings, press-fit designs, materials, and so on. Also, there are vast differences of opinion on the prophylaxis of deep venous thrombosis and various aspects of postoperative rehabilitation. Just as with the issue of prosthesis selection, it is not the intent to address these points, particularly cement versus no cement, as issues to be settled here; rather, the technical requirements for each are presented.

The relative roles of cemented versus uncemented arthroplasty and other controversial topics can be addressed elsewhere by individual papers, in published symposia, and orally at meetings. These issues did not seem to have a significant place in a text devoted principally to the technical planning and execution of the arthroplasty procedure. As such, it is hoped that much, if not most, of the information presented in the analyses rendered here will remain relevant as current controversies change and prostheses evolve.

Originally, this volume was meant to be short—ideally a surgeon or resident could read this book in one or two evenings. It was seen as a primer or handbook to be used together with a manufacturer's instructional text brochure. For the resident, such use might be seen as a "night before" activity when first encountering total knee arthroplasties. The subject matter, however, is quite complex and does not permit a brief or summary presentation if the issues are to be covered in adequate detail. While a relatively simple, straightforward total knee arthroplasty case is indeed just that, it is the more difficult cases that must be approached with both a broader and a deeper understanding. As a result, this volume developed into something more than a short primer or booklet. Furthermore, there are a few sections that may seem difficult and require careful attention for good understanding and retention.

For the resident or practitioner interested in a brief approach to this material, there are certain sections and topics of greater interest than others. In particular, the sections on assessment of difficulty, x-ray analysis, axial and rotational alignment pitfalls, and the intraoperative material can be considered. On the other hand, issues of patient selection, prosthesis selection, postoperative rehabilitation, and management of postoperative complaints may be viewed differently. These are topics that are clearly relevant to the overall purpose of this book, but their relevance is mainly seen before scheduling surgery or after performing the operation.

Finally, it should be understood that this volume is organized along a chronological scale, starting with preoperative issues, intraoperative topics, and postoperative management. It is true that all of these aspects of total knee arthroplasty should be mastered before getting into the operative arena and the purpose of this volume is to facilitate that mastery.

Kenneth A. Krackow

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Kenneth A. Krackow

THE TECHNIQUE OF Total Knee Arthroplasty

Contents

1

Patient Selection: Indications, Assessment, and Alternatives

It is true that there is no substitute for a poorly planned and executed arthroplasty, no matter how properly the patient was selected. However, a technically well-performed arthroplasty on the *wrong* patient can lead to patient dissatisfaction, significant complication, and even medicolegal litigation. Because of the essentially irrevocable nature of total joint arthroplasty, this chapter focuses on the process of determining (1) that there are not less drastic, reasonably effective treatments for the patients and (2) that provision of metal and plastic smooth joint surfaces is likely to improve the patient's state. Assessment of the orthopaedic complexity of the case and the complexity of the medical and social history of the patient completes the decision-making process to determine if total knee replacement is a reasonable treatment alternative at a given point in time.

This chapter further outlines a reasonably complete disclosure and informed consent process that includes the patient, as well, in this final decision. Finally, in the appendix a flow chart is outlined by which one may attempt to understand the process of offering total knee replacement surgery. The method quantifies and objectifies as much as possible the decision for total knee arthroplasty under certain assumptions.

PATIENT HISTORY

In a broad sense, the particular indications for total knee arthroplasty might be listed as knee pain, mechanical instability at the knee, and limited range of knee motion. From a practical standpoint, knee pain is the overwhelming consideration for nearly all patients. Occasionally, cases occur in typically older patients in whom fracture or degenerative alteration of joint surfaces has resulted in a knee that mechanically can not provide weight-bearing support function. Also, in rare cases the major concern at the knee may be decreased motion, ankylosis, or a bony fusion rather than pain. However, the last indications are quite rare, and in the case of decreased range of motion alone, they are possibly not even valid ones. As knee pain is such an important factor to be considered, its assessment, quantification, and documentation are primary.

The recorded history should provide characterization of pain, not only in general terms of severity, but also with its concomitants of requisite pain medica-

tion, use of weight-bearing assistive devices, presence or absence and relative degree of both rest and minimal activity pain, and also night pain. To record that the patient complains of "severe" pain is one thing; to characterize this as pain that is "severe with minimal turning activities or at rest or in bed," pain that requires the use of a walker and the ingestion of medium range oral narcotics, and pain that limits ambulation to a relatively short distance paints a clearer picture of the patient's state. Such "severe" pain is much more impressive than severe pain noted at the end of the day or after walking full weight bearing several times up and down a shopping mall.

Closely related to pain and otherwise related to structural characteristics of the knee is the issue of specific functions that the patient can perform. It is helpful to record those activities the patient is essentially unable to do as a result of the knee problem and his general activity level in terms of walking distance and use of weight-bearing assistive devices. At this stage, it is pertinent also to explore those activities the patient desires to perform as a result of surgery. The patient may want to return to a curtailed activity that a total knee arthroplasty patient would not be permitted to perform.

To help and lead the patient in the planning process, it is vitally important to obtain the patient's past and current work history if he or she is at all close to a working age. What type of work does the patient do? Is he still able to work? If so, is the end in sight? Has he been losing work time? What is the social economic situation at work with respect to sick leave, retirement? It must be clear that you are asking these questions not as part of a financial screening process to see if the patient can afford your services but rather as one of the most essential aspects of patient assessment and preoperative planning.

Particular points that require attention include (1) not performing a total knee replacement to get a patient back to the type of work that would likely be prohibited anyway, (2) not involving the patient in surgery that would overextend his sick leave benefits without his prior knowledge of this, (3) possibly waiting until full retirement age, if that is relatively soon and will make a substantial difference to the patient's long-term financial status, and (4) alternatively going ahead with surgery while the patient is employed if waiting until retirement places the patient in a severely disadvantageous position with respect to insurance and hospital expenses. Certainly the assumption implicit for this fourth point is that the patient is ultimately judged to be a candidate for total knee replacement. He certainly must not be hurried into surgery prematurely just because his insurance benefits are going to diminish at a later time. However, if the patient is a reasonable candidate and has himself been vacillating, consideration of these social and economic factors may be crucial.

Another important aspect of the patient's history for planning purposes is a thorough record of prior treatments and their respective results. To be sought specifically is a record of analgesic use and nonsteroidal antiinflammatory medications, frequency and response to intraarticular injections, physical therapy, brac-

HISTORY

PAIN

Original onset: Antecedent factors:
Recent onset: Antecedent factors:

History of same/similar problem:

Factors provoking symptoms: Helping symptoms:
General frequency of symptoms:

Location of pain:

Night pain: ___absent ___mild ___moderate ___severe ___every night ___most nights ___occasionally

Rest or "minimal activity" pain: ___absent ___mild ___moderate ___severe

Pain with weight bearing and general activity: ___not present ___mild ___moderate ___severe ___totally disabling

Specific symptoms: ___stiffness ___swelling ___accumulation of joint fluid ___walking ___catching ___giving way ___instability ___weakness

Analgesic/Nonsteroidal Anti Inflammatory Medication: Currently taking:
Those taken in the past:

FUNCTION

Assistive devices used: ___cane ___crutches ___walker ___wheelchair
F—Full-time P—Part-time

Walking distance with and without assistive device: ___one room ___around house ___around block ___several blocks ___farther ___unlimited ___unable to walk

Limp: ___none ___slight ___moderate ___severe

Features of history and examination delineated here are reasonably complete. This fact is not to imply that such a record represents the current standard of care or that any minor, moderate, or major deviation from this record necessarily implies any breach in standard of care.

HISTORY—*cont'd.*

Stair climbing (check as appropriate): ___normal ___lead one leg at a time ___necessary to hold on with one hand ___with both hands ___unable to climb stairs

Brace currently worn: ___yes ___no Type?_____
Type worn in the past: ___yes ___no Type?_____

Benefits (from brace):

Activities which are no longer possible:

Activities which are barely possible, possible only with excess pain:

Activities desired to return to:

Other aspects of past evaluation and treatment

Doctors seen:	Specialty, if any
_____	_____
_____	_____
_____	_____
_____	_____

Tests performed:

___Plain x-ray ___CT scan ___Arthogram ___Blood tests ___EMG-NCT ___Tomograms ___MRI Scan ___Bone scan ___Joint aspiration

Positive findings:

Formal physical therapy: Results:

Intraarticular injections: Frequency_____ Results_____

HISTORY—*cont'd.*

Previous Surgery	Type	Date	Result

Specific history of infection? Wound drainage?

WORK SITUATION

Occupation _____ Retired _____ Previous occupation _____
Last worked _____Out of work due to chief complaint: yes___ no___
Amount of time off work due to chief complaint in past year _____
Possibility of light duty: yes___ no___
Possibility of job change: yes___ no___
Time until retirement _____
Special restrictions concerning sick leave:

Other benefits:

PAST MEDICAL HISTORY (GENERAL MEDICAL BACKGROUND)

Major Diagnoses

Trouble with: ___Heart ___Lungs ___Kidneys ___Ulcers ___Thyroid ___Diabetes ___Blood pressure ___Other

Allergies:

Current medications taken:

Hospitalized in the past for:

History of phlebitis or other blood clot problems:

Specific knowledge of poor circulation to legs or feet:

ing, and prior surgery. The next step can be planned only when the earlier path is known. Furthermore, the patient's confidence is undermined if the physician begins to outline conservative management relying on one or more treatment modalities already proven unsuccessful.

Finally, the more standard features of the patient's past medical history must be considered. Such information is most commonly sought with an eye toward assessing not only the patient's chances of anesthestic mortality or morbidity, but also his potential for orthopaedic complication or morbidity at the extremity and for the purpose of trying to assess the patient's general life expectancy. Enthusiasm for offering total knee arthoplasty should reasonably diminish in some proportion as the patient's likelihood of complication and morbidity increases and also if the patient's general life expectancy is particularly long. Assuming no major concern for operative and anesthetic risk, one is certainly more confident offering a total joint replacement to a patient with reasonable life expectancy of 10 to 15 years as opposed to one of 20 to 25 years or more.

PHYSICAL EXAMINATION

In considering the physical examination, one should attempt to note any aspects of personality that might suggest neurosis or types of compulsive behavior that might portend relatively less satisfactory clinical results for a given objective improvement. Such patients may have exaggerated reactions to their albeit real orthopaedic pathologic conditions, and their expectations for treatment results can be unrealistic.

In addition to more specific points that will be discussed, an initial observation of the patient's gait in terms of general strength, mobility, and apparent discomfort is important. This gross assessment of disability and the patient's dysfunctional state can be extremely helpful.

It is desirable to document accurately certain aspects of the physical examination, such as the type and degree of deformity, range of motion, other aspects of alignment, ligament balance, and conditions for skin incisions. These points are also exceptionally important to note because many relate to one's ability to estimate technical difficulty, which is one of the first steps in the planning process. A detailed examination of the extremity, including assessment of general sensitivity of the knee, peripheral circulation, crepitation as an objective sign of degeneration, and patellofemoral sensitivity, is important.

Assessment of the hip, while not commonly revealing, is occasionally of supreme importance. Primary hip disease may present initially as knee pain—a well-known situation. In addition, it is possible to see patients even with fused hips complaining of significant knee symptoms with degeneration of the knee and no other outward complaint of hip pathologic conditions. That is, the pathologic conditions of the knee may be real, and the hip situation may not be evident or mentioned unless a specific hip range of motion is attempted, the patient is questioned on the point, or the hip is visualized by x-ray.

PHYSICAL EXAMINATION

GENERAL

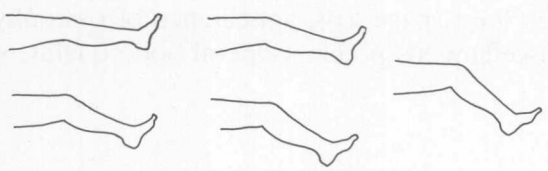
Personality: ___ average ___ stoic ___ moderate physical concern ___ perhaps exaggerated physical concern ___
General discomfort: ___ normal ___ mild
___ great ___ moderate
Body build: ___ lean ___ average ___ slightly obese ___ moderately obese ___ very obese
Gait: ___ antalgic ___ Trendelenberg ___ normal ___ unable to walk
Amount of obvious discomfort or disability: ___ none ___ mild ___ severe
Skin: ___ normal ___ ok scar ___ thin ___ inflamed
___ questionable vasculature
Overall alignment: ___ varus ___ valgus ___ flexion contracture
Swelling: _____ Effusion: _____
Muscle tone and bulk: ___ normal
___ none
___ wasting: ___ mild ___ moderate ___ marked
Quad strength: ___ normal ___ good ___ fair ___ poor
Palpation and tenderness: _____
Range of motion: (Record active and passive; Label right and left)

Stability: ___ medial ___ lateral ___ anterior ___ posterior
O = normal, 1+, 2+, 3+, 4+ unstable
Crepitation: ___ diffuse ___ localized ___ patellofemoral
Patellofemoral signs:

Other specific signs: (McMurray, Lachman, Pivot shift, etc.)
Pulses: (R) ___ DP ___ PT
(L) ___ DP ___ PT
Motor and sensory function:

RANGE OF MOTION

Circle the picture that best describes ability to *straighten* knee:



Circle the diagram that best describes ability to bend knee, that is the position to which it bends:
___ Check if no motion is possible
___ Check if only very slight motion is possible