Arthroscopy

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PREFACE

The authors of this monograph are leading orthopaedic surgeons who are masters of the art and science of modern arthroscopy. One contributor is a professor of both anatomy and orthopaedic surgery, and all have had extensive experience with disorders of the knee and other joints, as well as with the rapidly expanding discipline of clinical arthroscopy. Their combined expertise makes this volume a unique and practical guide both for the beginner and for the experienced arthroscopist.

For instance, the chapter on the future of arthroscopy presents a wide vista of the possibilities still ahead, providing a challenge for those engaged in research while provoking the curiosity of every arthroscopist. Other chapters deal with arthroscopic anatomy, arthroscopic technique in both the knee joint and the shoulder, and the history of arthroscopy. There is also an excellent presentation – in both text and illustrations – of important diseases and injuries of the knee joint.

I should like to congratulate the editor, Dr. Richard L. O'Connor, and all the authors on the publication of this splendid monograph. It should become part of the library of every orthopaedic surgeon who is interested in the knee joint and its many problems.

Masaki Watanabe, MD

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INTRODUCTION

From the *Lichtleiter* to the arthroscope – in the space of only 170 years – this is the story of man's progress in fulfilling his desire to study the interior of all the previously sacrosanct body cavities.

The endoscopic principles established by cystoscopy were first applied to the knee joint by Takagi at the University of Tokyo in 1918. Sporadically, over the years that followed, perceptive physicians throughout the world who wished to elevate their treatment of joint diseases to a more scientific level used and reported on various endoscopic devices to examine the interior of knee joints. However, it was not until the post-World War II boom in optics and electronics that a practical arthroscope was developed. Since then there have been important breakthroughs in our knowledge, first about the interior of the knee joint, and recently about other joints. That is the history recounted in this monograph.

But the monograph does far more: it defines the proper role of arthroscopy in the modern management of joint disorders, and explains both the "why" and the "how." How much better to know the exact pathologic condition within the knee – or other joint – *before* the application of a surgeon's knife! How much better to know that there is no surgically correctable lesion within the joint *before* an incision is made; indeed, how much wiser to identify pathologic changes that can best be treated by nonsurgical techniques early, *before* the pathologic process develops to an irreversible stage.

The benefits to be gained from arthroscopy outweigh the potential disadvantages of anesthesia, discomfort, and possible infection; the additional time required to perform an arthroscopic examination before treatment is usually well spent. However, arthroscopy should never replace clinical judgment and cannot make amends for clinical ineptitude. Arthroscopy should be used in conjunction with, and not as a replacement for, taking a good history and performing a careful physical examination.

It may also be well to say some of the things that "go without saying." Arthroscopy is, after all, a surgical procedure. It calls for careful patient selection, taking into account such factors as concomitant disease states, age, general condition of the patient, and sensitivity to anesthetic agents. During the examination, the patient's condition must be carefully monitored, with special attention to cardiovascular and respiratory function. And, of course, strict aseptic technique should always be observed.

In sum, useful as arthroscopy may be, it should not be undertaken lightly. As the monograph points out, some 20% of procedures present difficulty, and the problems encountered tend to vary inversely with the experience of the examiner.

All these are valid and important considerations. Certain other comments sometimes heard about arthroscopy are, however, not so valid. One criticism often voiced by some surgeons, for example, is: "Why peek through a keyhole, when you can open the door?" The obvious answer is that some knees, like some rooms, are spaces into which you do not wish, or have no need, to enter. Other critics state that it is usually unnecessary to use arthroscopy if one has a sound grasp of the clinical situation and sufficient experience to identify the clinical problems that might be present. The answer to such critics is that if they are proficient without arthroscopy, they would be even more proficient with it. Arthroscopy is not only here to stay but also represents a significant advance in the diagnosis and treatment of all disorders of synovial joints.

Robert W. Jackson, MD, MS (Tor), FRCS (C)

SECTION I

History of Arthroscopy

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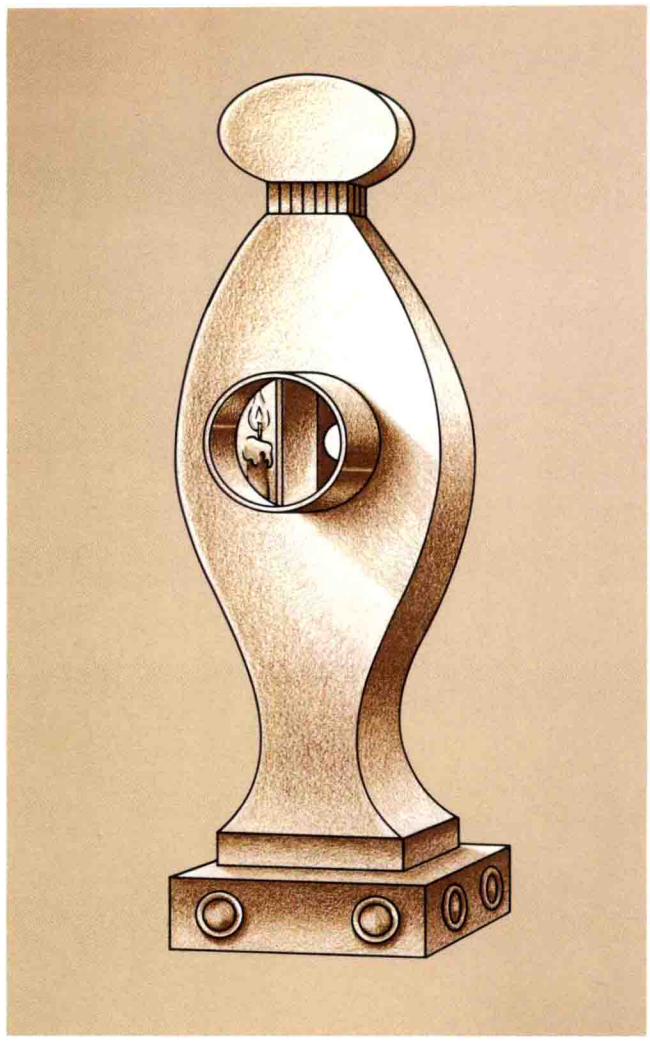
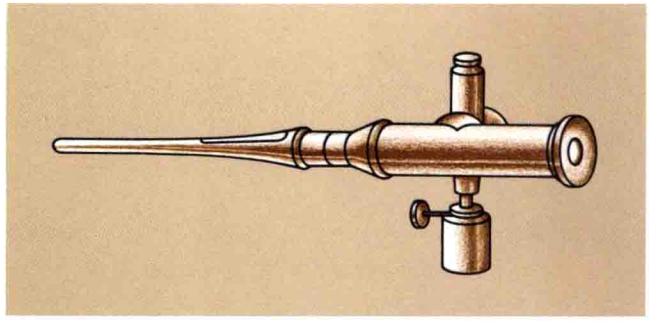
The development of the arthroscope is basically related to that of the cystoscope. Although the ancient Hebrews are said to have used vaginal speculae, and crude proctoscopes allegedly have been found in the ruins of Pompeii, no attempts to visualize other body cavities were made until Bozzini of Frankfurt-am-Main devised his *Lichtleiter*, or light conductor, in 1805. The instrument consisted of a light chamber encased in a boxlike stand. The chamber was divided by a partition. A candle on one side of the partition provided a source of light while the observer peered into the other side (Figure I-1). A "Y"-shaped metal tube was attached to a hole on either side of the partition at one end and entered the urethra at the other, enabling the examiner to view the field by reflected light from the candle. Unfortunately, the Viennese Medical Society was unimpressed by the device and considered it to be a mere toy.

Instruments of many types followed the *Lichtleiter*, but it was not until 1853, when Desmoreaux published his extensive experiences with endoscopy, that the procedure was considered to be worthwhile. His device consisted of a series of tubes attached to a gastrogen lamp. The observer looked through a perforated concave mirror that reflected the light into the bladder and urethra (Figure I-2).

Until the advent of electricity, reflected light provided the only means of illumination for inspection of the bladder. In 1876, Nitze devised an instrument that had a platinum loop encased in a goose quill, and which introduced light into the bladder. A flow of water around the instrument protected the tissues, and the addition of a lens system provided better visualization. The instrument was demonstrated before the Vienna Medical Society in March 1879. In October of the same year, the use of the instrument on a cadaver was demonstrated to the members of the Royal Medical Society of Saxony (Figure I-3).





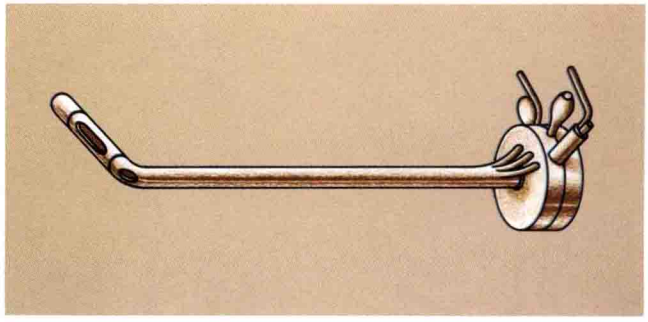


Figure I-1. Bozzini's *Lichtleiter.*

Figure I-2. The gastrogen arthroscope of Desmoreaux.

Figure I-3. The Nitze arthroscope.

Following the development of the incandescent lamp by Edison, small electric bulbs were used as light sources for the cystoscope. By the beginning of the twentieth century, the cystoscope had become an important urological tool.

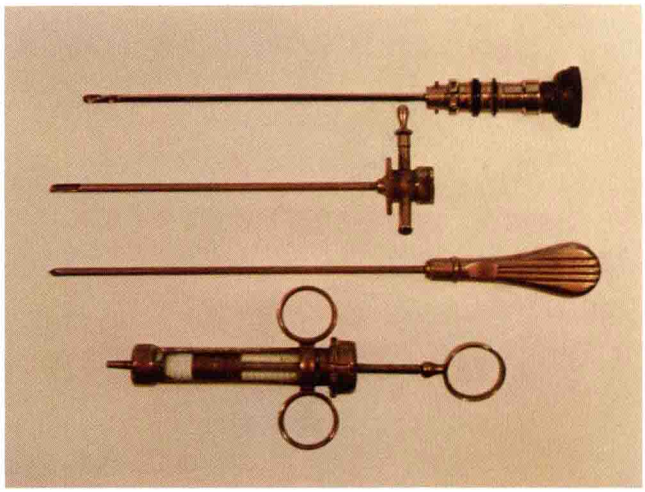
In 1918, in Tokyo, Takagi first inspected a cadaver knee through a cystoscope. The remarkably clear view of the joint encouraged him to design instruments better suited for inspection of joints. The 7.3 mm diameter of Takagi's first arthroscope, which appeared in 1920, made the device impractical for routine use, but the clarity of the image noted in the tuberculous knee in which the instrument was used encouraged Takagi to further efforts. By 1931, he succeeded in producing a scope with a 3.5 mm diameter, which was more suitable for inspecting the narrow confines of the solution-distended knee (Figure I-4).

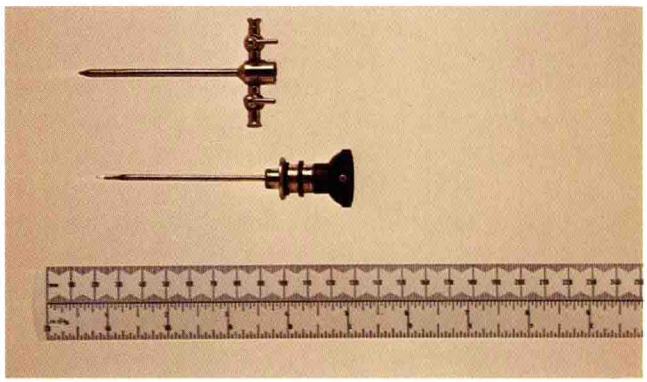
Bircher,[1] in 1921, reported the results of his findings in knees distended with oxygen or carbon dioxide and examined with a Jacobeus laparoscope. In 1925, Kreuscher[2] became the first American to report on the use of an arthroscope for the diagnosis of knee disorders. In 1931, Finkelstein and Mayer[3] reported their experiences with punch biopsies made through the arthroscope. In the same year, Burman[4] reported his experiences with arthroscopic examinations of the hip, knee, ankle, shoulder, elbow, and wrist. Not only was this the first publication describing the arthroscopic appearance of joints other than the knee, but it also remains a classic on the fundamental principles of the procedure. Furthermore, Burman developed his own arthroscope (Figure I-5A), with accessory instruments for surgical procedures (Figure I-5B).

In 1934, Burman, Finkelstein, and Mayer[5] reported on their findings in 30 knees and discussed the value of arthroscopy in the diagnosis of knee disorders.

Sommer[6] in 1937, Vaubel[7] in 1938, and Hurter[8] in 1955 reported their experiences with the procedure. In

Figure I-4. The first Takagi arthroscope.





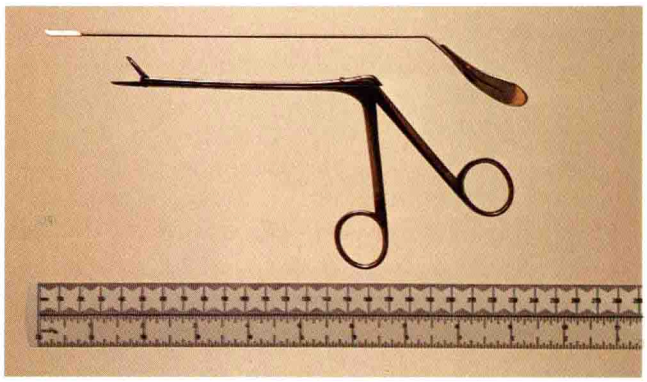
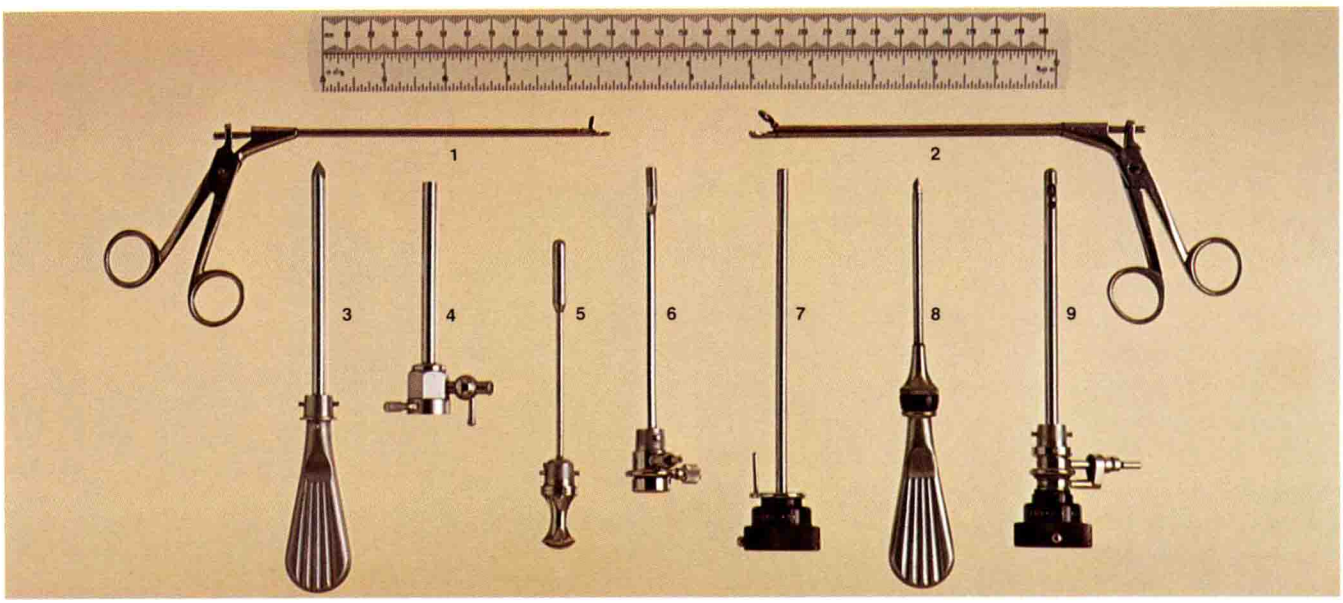


Figure I-5A. The Burman arthroscope.

Figure I-5B. Burman accessories: (top) knife; (bottom) forceps.

Figure I-6. The Watanabe Number 21 arthroscope.
1, 2 – biopsy forceps; **3** – trocar; **4** – sheath; **5** – obturator; **6** – bulb carrier; **7** – direct viewing scope; **8** – accessory trocar (in sheath); **9** – right-angle scope.



1957 Watanabe published his *Atlas of Arthroscopy*, which was revised in 1969.[9]

Casscells, in 1971,[10] published the first analytical paper in the United States that demonstrated the accuracy of arthroscopy when compared with other diagnostic measures, and in 1972 and 1973, Jackson[11,12] reported his experiences. Both authors were using the Watanabe Number 21 arthroscope (Figure I-6).

In 1973, Watanabe[13] made a preliminary report on the Selfoc "Needlescope," a fiberoptic instrument which has since been greatly refined and is now being manufactured in diameters of 2.2 mm (Figure I-7) and 1.7 mm (Figure I-8). This ingenious instrument has been used to examine many of the smaller joints, including the shoulder, elbow, wrist, and metacarpophalangeal joints in the upper limb. In the lower extremity, arthroscopes have been used in the hip, knee, ankle, subtalar, and metatarsophalangeal joints (Figures I-9, I-10).

More recently, Johnson* has demonstrated the more extensive examination of the knee and smaller joints cinematographically; DeHaven[14] has reported his findings comparing the diagnostic accuracy of clinical examination, arthrography, and arthroscopy; and both O'Connor† and Ikeuchi‡ have demonstrated the value of surgical procedures performed under arthroscopic guidance.

By 1973, arthroscopy had become so well established that the first instructional course on the subject was given in Philadelphia under the sponsorship of the University of Pennsylvania. The course was repeated in 1974, the same year the International Arthroscopy Association was founded (also in Philadelphia). The society already has some 400 members in various countries and is expanding rapidly; the second congress was held in Copenhagen in 1975.

Today, the technique of arthroscopy is rapidly expanding. Its boundaries are as yet unknown, and it has been shown to be of great value in the diagnosis and treatment of joint disorders. Concurrently, more efficient instruments are being perfected (Figure I-11A, B).

*Johnson LL, oral communication, 1976.
†O'Connor RL, oral communication, 1976.
‡Ikeuchi H, oral communication, 1975.