H.-R. Henche · J. Holder

Arthroscopy of the Knee Joint

Second, Revised and Enlarged Edition

With Forewords by Robert W. Jackson
and Erwin Morscher

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Diagnosis and Operative Techniques

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Drawings by Franz Freuler and Manfred Jauch
Translated by David Le Vay

With 225 Figures Mostly in Color

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Foreword to the Second Edition

A quarter of a century has gone by since the Western orthopaedic world reawoke to the potential benefits of arthroscopy. In the early days of this awakening, diagnostic problems were the only indication for arthroscopy, as the master surgeons of that era were confident in their clinical diagnoses and in their ability to treat any disorder of the knee through a large incision.

Two important changes subsequently took place. Firstly, it became apparent that most clinical diagnoses, while not actually erroneous, frequently failed fully to elucidate the problems within the knee joint. Arthroscopic examination led to a marked increase in diagnostic accuracy.

The second important change consisted in the development of arthroscopic surgical techniques. The ability to see pathology was coupled with a desire to treat it under arthroscopic control. This led to the development of new instruments and new techniques that enabled a large variety of conditions to be treated. With the passage of time it has become abundantly clear that the minimal intervention techniques used in arthroscopic surgery are far superior to the traditional, massive, open arthrotomy techniques. For example, there is little doubt that partial meniscectomy gives better long-term results than total meniscectomy.

During this evolutionary period Dr. Henche continued the pioneering work of Bircher and developed the technique of gas arthroscopy to a high degree of proficiency. He also developed several surgical techniques and is regarded as one of the great teachers of arthroscopy. This textbook, originally published in German, is one of the most complete treatises on arthroscopy and arthroscopic surgery available today. The skilful translation results in a book that is readable and understandable. In addition, the illustrations are excellent and have been reproduced with great care. The result is a very pleasing and informative book.

It is an honour to write the foreword for this significant milestone in the history of arthroscopy and arthroscopic surgery. This beautiful book is a tribute to the hard work and pioneering activities of Dr. Henche and I congratulate him.

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Foreword to the First Edition

In 1921 the Swiss surgeon Bircher published the first report on arthroscopy of the knee joint. The initial trials with the method revealed problems, mainly technical in origin, which caused it to be abandoned and forgotten until recently. Modern technical improvements, for which Japanese orthopaedic surgeons, above all Watanabe, were mainly responsible, have now led to a revival of interest in this method of investigation. The quality and versatility of the instruments currently available and the experience of the endoscopists who use them are such that arthroscopy of the knee joint is becoming an indispensable diagnostic aid. Arthroscopy is superior to arthrotomy in every respect; it is not only simpler but can be carried out on an ambulatory basis under local anaesthesia. In addition, it provides more information than arthrotomy, and the arthroscopic findings can be simply documented photographically. The complication rate is extremely low; cumulated statistics recently obtained from six clinics revealed no case of infection following nearly 4,000 arthroscopies. The main indication for arthroscopy is the "painful, diagnostically obscure knee joint" in the widest sense. The procedure is also useful for further investigation of knee joint lesions which have already been diagnosed, as it allows their type and extent to be diagnosed more precisely, and the indication for surgery in a given case can be assessed more clearly. Unnecessary surgery can often be avoided in this manner. Arthroscopic biopsy is simple, and a variety of operations (e.g. cartilage transplantation) can be followed up endoscopically.

Since 1971, arthroscopy of the knee joint has been carried out systematically at the Orthopaedic Clinic of the University of Basel by Dr. H.R. Henche, and the associated technique has gradually been improved. In particular, Dr. Henche has succeeded in perfecting endoscopy of the gas-filled joint and has developed it into a standard procedure. Dr. Henche has summarized his experience of over 500 arthroscopies in this manual, which provides an introduction to, and a practical description of the technique for the surgeon who has to deal with the diseased or injured knee joint.

Finally, it must be emphasized that the development of arthroscopy is continuing, and there is no doubt that the ability to perform endoscopic surgery will be included among the benefits which future technical advances will bring.

Basel

Professor Dr. Erwin Morscher

Preface to the Second Edition

Arthroscopy and arthroscopic surgery are achieving a prominence unimaginable a little over a decade ago. This rapid development has made a new edition of this book necessary. On careful examination, however, it can be seen that this is not merely a new edition, but that the whole book has been substantially modified and greatly expanded. To make it possible to present a complete overview of the various diagnostic and, in particular, operative techniques involved in arthroscopic procedures, Jörg Holder agreed to collaborate on this edition of the book, bringing with him his very wide experience. A further advantage is that Holder, as a great advocate of "fluid filling" goes into this technique in detail. Readers can inform themselves about the techniques of both gas and fluid filling and then make their own choice of method.

In comparison with the first edition, it is particularly noticeable that arthroscopy is no longer aimed primarily at diagnosis but is clearly focused on therapy – this tendency will become even more apparent in future years.

We are grateful to everyone who has contributed to the completion of this second edition of the book, and would especially like to thank both of our artists.

Rheinfelden-Frankfurt
September 1988

Hans-Rudolf Henche
Jörg Holder

Preface to the First Edition

The possibility of using a slender optical device to look into the knee joint and directly diagnose the causes of otherwise cryptogenic joint problems has fascinated surgeons since the beginning of this century. Eugen Bircher and Kenji Takagi took up this challenge independently at the beginning of the twentieth century. They earned no laurels from their contemporaries, as they were unable to document their findings and thus provide evidence with which to reassure the doubters.

Diseases of the cartilage of the knee joint are difficult to diagnose and assess clinically, and this explains the early interest in arthroscopy at an orthopaedic clinic such as that in Basel. My teacher, Prof. Erwin Morscher, had been convinced by Robert W. Jackson in Toronto that it was possible to inspect the inside of the knee joint by arthroscopy. On becoming Director of the Orthopedic Clinic in Basel in 1971 he asked me to study and develop the technique of knee joint arthroscopy, a commission which I regarded at that time as an unwelcome duty. In 1971 we began to carry out arthroscopy on patients whose diagnosis was clear and on those in whom arthrotomy was to be carried out immediately following the arthroscopy. The results of our first arthroscopies were frequently scanty. We followed the techniques described by Watanabe in his arthroscopy atlas, but nevertheless we seldom succeeded in precisely identifying an area of cartilage.

With the aid of all the members of the surgical team the technique described was developed in the years 1971–1972. I am particularly grateful to Professor Hugin, who assisted me in the solution of technical problems.

In recent years investigation of joints by arthroscopy has gained acceptance in many clinics. The questions and requests of colleagues who wished to start using the method gave me the idea of summarizing my experience in the form of a book. This monograph is also intended to encourage those who, like me, have been disappointed by the unsatisfactory initial results of this apparently simple method. For this reason an ample proportion of this "recipe book" is devoted to the complications and sources of error.

Dr. Franz Freuler contributed greatly to this book by furnishing the diagrams which accompany the photographs. I am very grateful to him for his collaboration. In preparing the photographic documentation I received considerable help from Mrs. Thierstein; the high quality of the documentation could not have been achieved without her skill and cooperation. Finally, I should like to thank Miss R. Wagner and her secretarial colleagues.

This book is being published at a time when arthroscopy is leaving the experimental phase and becoming a routine clinical method. There is no doubt that it will gain enormously in popularity in the coming years. If this book succeeds in fuelling the latter process it will have achieved its purpose.

Rheinfelden

H.-R. Henche

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Slides

A. Gächter, F. Freuler

Arthroscopic Findings in the Knee Joint

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The usefulness of arthroscopic examination of the knee is not limited to revealing lesions of the meniscus: far more than this, the strength of the method, for a physician experienced in arthroscopy, lies in the possibilities it offers for identification of complex lesions as well. The combination of new traumatic damage with older, degenerative changes is a frequent finding. Ruptured ligaments also often occur in conjunction with other lesions; for instance, a rupture of the anterior cruciate ligament may be combined with damage to the cartilage of the medial condyle, avulsion of the posterior horn of the medial meniscus, or rupture of corner the semimembranous with concomitant dislocation of the patella. Arthroscopy also makes it possible simultaneously to carry out a test of function with the benefit of intraarticular vision; the implications of the injuries and the exact treatment procedure to be followed, operative or conservative, can thus be established.

For correct identification of injuries, clinical knowledge needs to be supplemented by familiarity with the visual findings. Recognition is dependent upon knowledge, and it is in order to deepen clinicians' knowledge of arthroscopy that this double series of slides has been created, in which *each* arthroscopic image is paired with an explanatory line drawing. Out of the 8000 arthroscopic examinations carried out at the University Orthopaedic Hospital in Basel, examples of important findings of types that are seen daily in arthroscopy were selected and photographed. The photographs are accompanied by a brief commentary linking the arthroscopic findings to clinical findings and differential diagnosis. The selection of clear and unambiguous images was a priority. All pictures were taken using the anterolateral approach and an optical angle of 30°. The use of carbon dioxide as a medium has made the pictures of the lesions very true to life, without synovial fluid obstructing the clear view. Where necessary, a series of photographs was taken of a single case in order to clarify the findings from different angles of vision.

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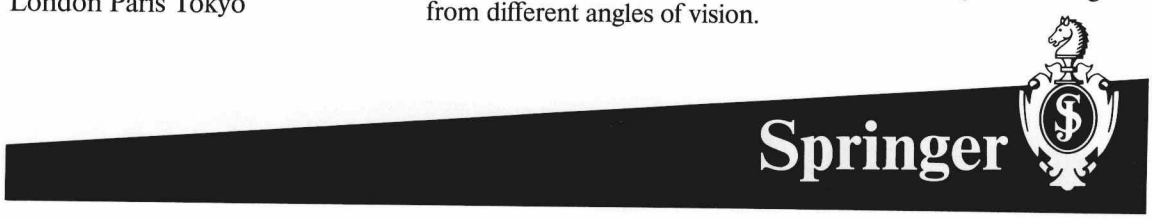

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CHAPTER 1

Historical Review

The attempts of doctors to look into the human body cavities have a very long history. In the first half of the nineteenth century it became possible to visualize the larynx, the ear and the optic fundus. The names of Ludwig Thürk, Freiherr von Troeltsch and Herrmann Helmholtz are indelibly associated with these pioneer developments.

The creation of the white-hot platinum wire led to the invention of the electric light and made it possible to illuminate the body cavities. The first attempts at endoscopy of the urinary bladder and the stomach were carried out in the second half of the nineteenth century. Max Nitze is regarded as the father of cystoscopy. In May 1879, with the aid of a device developed by himself and the instrument maker Joseph Leitner, he was able to examine the interior of the bladder. The first successful gastroscopy was probably that carried out by Mikulicz in Breslau. By 1881 he had succeeded in visualizing individual features in the stomach, such as the activity of the pylorus.

The invention of the carbon-filament light bulb by Thomas Edison enabled considerable advances to be made in endoscopy of all kinds. At the turn of the century cystoscopy had already become a routine procedure. A few years later gastroscopes – still rigid at that time – became available. Laparoscopy was a more or less parallel development. Jacobaeus, together with the Georg Wolf Company, designed an instrument for the inspection of the peritoneal cavity. This was the instrument which was first used for endoscopy of the knee joint.

In 1919/1920 the Swiss surgeon, Eugen Bircher (Fig. 1), carried out the first experimental endoscopies of cadaver knee joints using the Jacobaeus laparoscope. In 1920/1921 the technique was used in living humans. In

Fig. 1. Eugen Bircher

his famous paper – the first publication whatsoever on arthroscopy – in the *Zentralblatt für Chirurgie* in 1921 he reported the use of the laparoscope for arthroscopy of the knee joints of 18 patients. In 13 cases he was able to establish a correct diagnosis which was confirmed by the subsequent operation. In three cases the diagnosis was unsure. He reported only two incorrect diagnoses in tuberculous joints. Bircher carried out the investigation under general anesthesia in almost all cases. The joints were filled with oxygen and nitrogen.

One year later, in 1922, Bircher published an article on the pathology and diagnosis of meniscus injuries in 20 knee joints which had been investigated endoscopically. Even at that stage he succeeded in endoscopically diagnosing eight out of nine meniscus inju-

ries, the diagnoses being confirmed during subsequent surgery. At the end of the paper Eugen Bircher wrote: "Arthroscopy allows us to examine the interior of the joint and identify pathologic changes, i.e., the diagnosis is made by direct visualization of the lesion. It is therefore superior to all other methods of investigation and, like endoscopy of the bladder, can be used to define certain indications for surgery. It will meet with resistance, as did cystoscopy, but, like the latter procedure, will gain in popularity and develop of the point at which it becomes indispensable."

In 1918 the Tokyo surgeon K. Takagi (Fig. 2) had, independently of Bircher, experimented with the use of a cystoscope for the visualization of the interior of the knee joint, or so his pupil, M. Watanabe, reports. In 1920 he developed a special device with a diameter of 7.3 mm for endoscopy of the knee joint (Fig. 3). However, because of its thickness this instrument was not suitable for practical use. It was not until 1931 that he succeeded in developing an arthroscope with a diameter of 3.5 mm. Takagi expanded the interior of the knee joint by filling it with saline. The first publication concerning his arthroscope appeared in 1933 in the *Japanese Journal of Orthopedic Surgery*.

Fig. 2. K. Takagi

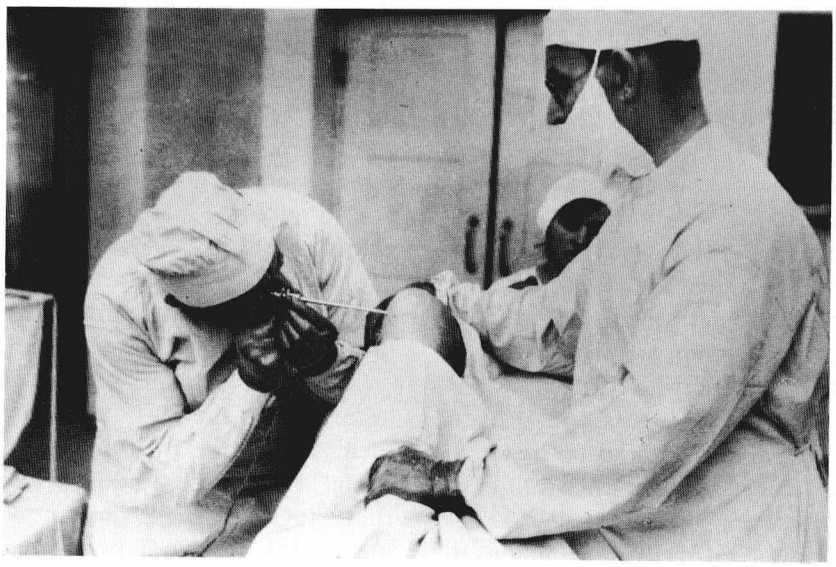

Fig. 3. Arthroscopy at the Kantonsspital, Aarau, 1920

The first paper on arthroscopy of the knee joint in English was that by P.H. Kreuscher in 1925 in which he described an arthroscope of his own development. He considered arthroscopy to be especially suitable for the early detection of meniscus injuries.

In New York at the beginning of the 1930s M.S. Burman, H. Finkelstein, and L. Mayer at the Hospital for Joint Diseases were also working on an instrument for arthroscopy of the knee joint. Following a short publication in 1931, the current state of development was summarized in a paper in 1934. This article described for the first time a clearly defined technique of arthroscopy. The authors preferred local anesthesia. The irrigation was carried out with Ringer solution. A description of the systematic inspection of the knee joint was followed by a clear account of the complications which could arise during the procedure. They reported 30 cases which they had investigated, and concluded that arthritis of the knee joint and meniscus lesions were the main indications for arthroscopy of the knee joint.

The development of this investigative technique was continued in Germany. In 1937 R. Sommer reported several cases in which he had carried out arthroscopy, although his paper in the *Zentralblatt für Chirurgie* did not deal with the technique and complications in detail. Like Sommer, the rheumatologist J. Vaupel was only familiar with Bircher's initial work as he tried to introduce arthroscopy for the diagnosis of lesions of the knee joint. As a rheumatologist, Vaupel stressed the importance of the method in chronic arthritis. He arthroscoped individual knee joints as many as three times and hoped, by following the changes in the appearance of the synovial membrane, to gain insight into the course of the disease. Vaupel also tried to record his findings photographically. He used an arthroscope with a diameter of 3.1 mm for normal investigations and developed an instrument with a diameter of 4.7 mm for those cases which he wished to photograph. However, the underdeveloped state of photographic technology at that time prevented him from obtaining satisfactory pictures.

In 1939 K.H. Wilcke published a good review of the state of arthroscopic technology in the German- and English-speaking countries. Wilcke carried out his arthroscopies exclusively in cadavers. He described the technique of the investigation precisely. The colored photographs provide evidence of the technical inadequacy of the photographic methods available at that time. In his summary Wilcke wrote: "Endoscopy is, in suitable cases, a worthwhile addition to the methods which are available for the investigation and diagnosis of lesions of the knee joint, but its value is not such that it could be recommended for routine use in living patients."

After the Second World War the main impetus in the development of arthroscopy of the knee joint came from Japan. At the annual meeting of the Japanese Orthopedic Association in 1953 M. Watanabe, K. Sato, and W. Kawashima presented a report on the clinical use of the technique. Four years later, in 1957, the first edition of the *Atlas of Arthroscopy* by M. Watanabe, S. Taketa, and H. Ikeuchi was published. This atlas was the basis of the subsequent world-wide increase in interest in arthroscopy of the knee joint.

Arthroscopic surgery also began in Japan, where, on April 5, 1962, Watanabe did the first partial removal of a meniscus. Initially it was very difficult, and it was O'Connor's great achievement to have markedly improved the technique of operative arthroscopy. The publications of R. Jackson and L. Johnson also marked important steps in the development of many arthroscopic procedures. It was not until the 1970s that the Europeans acquired the technique from the Americans. From England (Dandy) and Sweden (Eriksson, Gillquist) the use of arthroscopy (initially diagnostic, but soon followed by operative methods) spread and became established in other European countries.