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MECHANICAL DERANGEMENTS OF THE KNEE JOINT*

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Mechanical derangements of the knee joint are relatively common and may be due to either extrinsic causes such as exostoses, or to intrinsic causes such as fractured internal semilunar cartilage. It is to the latter, which are the most difficult to diagnose, that attention will be drawn in this paper.

ANATOMY

The knee joint is a hinge joint. While nature was apparently most lax in providing bony reinforcements to the knee, she has been most ingenious in furnishing ligaments strong enough to take up the strains imposed. In front is the anterior or big patellar ligament. This has a ligamentous or tendinous attachment below and a muscular attachment above. Its action as a true ligament, therefore, is not very great. On the inner side is the internal lateral ligament, short, strong and fan shaped, with its narrow part downward, and having its deep portion intimately associated with the capsule and the internal semilunar cartilage. The deep fibers, being short, keep the internal semilunar close to the condyles of the femur. On the outer side the external lateral ligament extends from the external tuberosity of the femur to the head of the fibula, splitting the tendon of the biceps in its course. This ligament has two divisions, a weak posterior part and a strong anterior part. It is separated from the capsule of the joint by the popliteus tendon and the bursa found there. The two lateral ligaments are the chief agents in providing against lateral mobility; the internal lateral preventing the knee from bending outward, and the external lateral preventing the knee from bending inward. The rounded ends of the femur are buttressed, as it were, by the internal and external semilunar cartilages, and thus the lateral ligaments are aided in their function (Fig. 1).

The internal semilunar cartilage forms a large segment of a circle and is less movable than the external. Posteriorly it is firmly attached just in front of the posterior crucial ligament. Anteriorly it is less firmly attached in front of the anterior crucial ligament. Internally it has a firm attachment to the lateral ligament and a somewhat weak attachment to the tibia by the coronary ligament.

The external semilunar cartilage forms a smaller segment of a circle. Occasionally it is nearly a complete circle, there being only a small opening against the tibial spine, as in three of the 150 specimens examined by Tenney.¹ The external semilunar is fixed anteriorly in front of the tibial spine, and posteriorly to the tibial spine between the tubercles, giving a strong slip to the posterior crucial ligament. The attachments to the external lateral ligaments and the tibia are very weak. The semilunar bodies are spoken of as being cartilaginous. In reality, they are fibrocartilaginous, the thick convex part being largely fibrous tissue, and only the inner concave portion cartilaginous. When this cartilaginous border is injured, small pieces of cartilage may become separated and loose. The fibrous tissue is arranged transversely and longitudinally. The longitudinal fibers may continue anteriorly across to the opposite cartilage, forming the transverse ligament—an insignificant structure. At the convex borders, the transverse fibers blend with the capsule. The coronary ligaments are formed by these fibers below and are really only the portion of the capsule between the semilunars and the tibia.

The anterior and posterior crucial ligaments are two very important internal ligaments. The anterior arises from the front of the spine of the tibia near the anterior extremity of the external semilunar cartilage and courses upward, outward and backward to the inner side of the outer condyle of the femur. The posterior arises from the back of the groove on the posterior side of the top of the tibia and from its outer border, leaving the floor of the groove and the transverse piece of the spine of the tibia free and covered by synovial membrane. Here it is closely connected with the external semilunar cartilage and runs forward, upward and a little inward to the front of the outer side of the inner condyle of the femur and of the intercondylar notch (Piersol²). These ligaments greatly aid in the stability of the joint. Griffiths³ states that if the internal or external lateral ligament is divided and lateral bending is attempted with the knee extended, the bending allowed is considerable, but if the same is attempted with the knee in the flexed position no bending is allowed laterally. He concludes, therefore, that inward bending of the knee joint is prevented in the extended position by the internal lateral ligament, and in the flexed position by the crucials. In flexion the relaxation of the internal lateral ligament allows some rotation. With the knee partially flexed, extension may pull on the anterior or upper part of the

1. Tenney, B.: The Anatomy and Surgery of the Internal Derangements of the Knee Joint, Ann. Surg., 1904, 40, 1.

2. Piersol, G. A.: Human Anatomy, Ed. 4, Philadelphia, J. B. Lippincott Company, 1913, 1, 404.

3. Griffiths, J.: Observations upon Injuries to the Internal Lateral Ligament and to the Internal Semilunar Cartilage of the Knee Joint, Brit. Med. Jour., 1900, 2, 1171.

* From the Mayo Clinic.

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internal lateral ligament and thus make some traction directly on the internal semilunar cartilage, there being a few fibers of the quadriceps inserted there. This may explain why the anterior extremity of this cartilage occasionally becomes caught and ripped. Jones⁴ says experiments show that hyperextension of the knee is prevented by (1) the posterior crucial, (2) the anterior crucial, (3) the internal lateral ligament, (4) the external lateral ligament, and that increased extension is secured as one after another of these is divided. Internal rotation is limited by the internal lateral ligament and the anterior crucial. In external rotation the tibia may slip slightly forward on the femur but is stopped by the anterior crucial. On internal rotation the tibia may slip back a little but is stopped by the posterior crucial.

Mechanical derangements produced by intrinsic causes will be considered under the following heads:

1. Semilunar cartilages.
2. Loose bodies:
 - (a) Of intrinsic origin — chondral and osteochondral bodies.
 - (b) Of extrinsic origin — foreign bodies.
3. Synovial fringes.
4. Crucial ligaments.

DERANGEMENTS DUE TO THE SEMILUNAR CARTILAGES

In the English medical literature there are many reports of large series of cases of damage to the semilunar cartilages, but those reported in the American literature are few. This is accounted for largely, I believe, by the fact that the English, as a class, participate much more freely in vigorous pastimes such as football, Rugby, tennis, hockey, etc., than do Americans. In America the clerk or laboring man seldom indulges in such pastimes, while in England he participates in them freely.

As stated previously, when the knee joint is partially flexed a little lateral mobility is permitted. This is due to the fact that the internal lateral ligament is relaxed. As it slacks, however, the crucial ligaments take up their duties so that when the knee is at right angles, the lateral mobility is checked. From 25 to 90 degrees' flexion is an arc of weakness, and it is in this arc that damage to the internal semilunar is most frequently inflicted. According to Jones,⁶ the most frequent cause of injury to the internal meniscus is strain thrown on the internal lateral ligament when the tibia is rotated outward while the knee is flexed. In rare instances he has known it to occur when the knee was extended; but, as emphasized by Lane,⁶ the internal fibrocartilage is injured in such cases only by great force. In extension, the internal lateral ligament is taut and performing its function, and it must be torn before the internal semilunar fibrocartilage can be displaced. In moderate flexion the crucials are not in a position to maintain stability, and the internal lateral ligament being slightly relaxed, some mobility of the internal semilunar is allowed. On attempted extension there may be a slight pull on the anterior extremity of the semilunar cartilage by the prolongation of the quadriceps muscle inserted into that part of the capsule, and the cartilage may be caught between the joint surfaces and torn loose or pos-

sibly fractured as the leg is straightened. Martin⁷ states that damage to the internal semilunar is common among coal miners who stand with the knees more or less flexed in low seams (4 by 4½ feet) in the mines. A review of our case histories has demonstrated that in the majority of instances the accident occurred with the leg partially flexed, the foot abducted and rotated outward, and force applied which caused the tibia to be rotated outward or the femur to be rotated inward, depending on whether the force was applied above or below the plane of the knee.

Locking of the joint is followed by effusion. The pain is often so severe as to make the patient cry out and fall to the ground, grasping the knee with both hands. It is usually most severe at the primary locking, and lessens as the locking becomes more frequent, until by some patients the pain is complained of less than the mechanical obstruction blocking the extension of the leg. The effusion may be considerable following the early locking, but as the lockings become more frequent the joint seems to accustom itself to the condition, and very little if any appreciable amount is noted. In some cases the locking may not be distinct, the patient complaining only that "things do not feel right in the joint." A diagnosis of a damaged fibrocartilage should be made in such cases only after very careful examination and consideration. The roentgenogram is of practically no aid, as in the great majority of instances the fibrocartilaginous body of the misplaced cartilage casts no shadow. Occasionally in persons with a history of lockings extending over many years the irritation inflicted on a pedunculated end of the internal semilunar will so harden it that a faint shadow will show in the roentgenogram between the internal condyle of the femur and the tuberosity of the tibia. In such cases, however, the history is usually so clear that the roentgenogram is not a necessary aid in the diagnosis. Nevertheless, any patient with mechanical derangement of the knee should have the benefit of the roentgenographic examination, for it is impossible to differentiate in many cases between a misplaced or loose internal semilunar or external semilunar cartilage and a loose body. The roentgenogram, therefore, may be considered as of the greatest aid in making a differential diagnosis.

It must be constantly borne in mind that while the most frequent cause of mechanical derangement of the knee joint is an injured internal meniscus, other causes also may produce the derangement. In some instances a diagnosis is extremely difficult before operation, and even after the joint is opened the cause is not evident. Surgeons of great experience have acknowledged that occasionally after making a careful search for the condition causing the symptoms complained of, they have closed the knee joint without repairing or removing anything. The removal of the internal semilunar cartilage must be decided from the findings.

According to Lane,⁶ periodic derangements of the knee joint may so lower the vitality of the joint tissues that tuberculosis develops. In his opinion the majority of cases of tuberculosis of the knee joint have this as their predisposing factor, particularly in persons who have intestinal stasis. In this contention he is supported by Jones,⁴ who adds that rheumatoid

4. Jones, R.: Notes on Derangements of the Knee, *Ann. Surg.*, 1909, **50**, 969.

5. Jones, R.: Internal Derangements of the Knee, *Lancet*, London, 1914, **2**, 297.

6. Lane, W. A.: Some of the Common Injuries of the Knee Joint and Their Consequences, *Brit. Med. Jour.*, 1911, **1**, 537.

7. Martin, A. M.: Discussion on the Diagnosis and Treatment of Injuries of the Knee Joint Other than Fractures and Dislocations, *Brit. Med. Jour.*, 1913, **2**, 1070.

arthritis also may be so induced. I have seen a few cases of tuberculosis of the knee in which there was a history of mechanical derangements for some years preceding the onset of the tuberculous arthritis. Such a history, however, was the exception rather than the rule.

The treatment of derangement due to the internal semilunar cartilage is either nonoperative or operative. It may be taken as a rule that patients should not be operated on who give a history of only one locking. If seen immediately after the accident, reduction should be made at once. Complete extension, and the statement of the patient that the joint feels right, is evidence that reduction of the displaced cartilage has been effected. If the patient insists that the reduction is not accomplished, it is probable that he is correct. After successful reduction, rest in bed should be insisted on until the effusion has subsided. Flexion of the knee and strain on the internal lateral ligament should be prevented for six weeks. If the damaged cartilage is given the opportunity to unite firmly in its normal position, the chances for a cure are very good. If the primary care has been careless and the fixation period inadequate, the patient very often presents himself with a story of multiple lockings. In these old cases, operative interference is necessary, for rest and immobilization at this late time will not insure the fixation of the loose cartilage in its normal position. When operation is necessary for removal of the internal meniscus, the incision of choice is the condylar incision of Jones. It is not necessary to remove the entire cartilage; the anterior three fifths is usually sufficient. Damage to the internal lateral ligament may be avoided by limiting the incision and by leaving a thin rim of the fibrocartilage attached to the internal lateral wall of the joint. This can be done easily by using a tenotomy knife to separate the cartilage, thus avoiding the deep fibers of the internal lateral ligament.

In my series of cases there has been none in which we have found it necessary to remove the external semilunar cartilage. Jones⁴ found it necessary to remove it in twenty-four cases, 7 per cent. of his total. He explains the rarity of damage to this cartilage on the ground that, unlike the internal semilunar which is securely fastened by its ligaments and cannot slide out of the way of harm, the external semilunar is more loosely attached and thus escapes injury. However, it should be borne in mind when making a diagnosis that the external cartilage is not immune to damage.

LOOSE CHONDRAL AND OSTEOCHONDRAL BODIES

Relatively speaking, loose bodies of cartilaginous or osteocartilaginous consistency are common. They may be either free or pedunculated. Very often when the body is cast off from one of the articular surfaces a piece of spongy bone comes with it. As the body wanders about the joint it receives nourishment sufficient to permit the growth of cartilage until it is entirely covered. Then only by section of the body can the bone be demonstrated (Fig. 2).

The etiology of loose bodies is interesting. It is generally conceded that a certain definite group have osteoarthritis or Charcot's disease of the joint as their primary cause. This group, however, does not directly concern the surgical aspect of the subject, for in such

cases the disease is more important than the mechanical difficulties, which are only incidental. The majority of loose bodies in the knee joint cannot be explained on these grounds, and it is this majority that is of the greatest interest. Whitelocke⁸ believes that many of them have their origin in the fibrous tags that hang from the synovial membrane. He states that as the synovial membrane, articular cartilages and interarticular cartilages are developed from the same primitive embryonic intermediate layer of the axial blastema, these fibrous tags may readily develop into loose bodies of chondral nature. Koenig,⁹ on the other hand, described osteochondritis dissecans as being the cause of loose bodies. Ridlon¹⁰ and Freiberg¹¹ have more recently called our attention to this condition and reported cases. Briefly, it is supposed that the pathology causing osteochondritis dissecans is a blocking of one of the nutrient end-arteries supplying the joint surfaces, with a consequent desiccation of the localized devital-

Fig. 1.—Intrinsic structures of the knee joint.

ized area as a free or pedunculated body. Undoubtedly there are such cases. However, it is very difficult to estimate the amount of trauma that may be inflicted on a joint surface by the crushing force exerted on attempted extension of the knee by a curled or crumpled up semilunar cartilage. Owing to its fibrocartilaginous structure, the semilunar cartilage may itself escape any serious damage and yet severely injure the cartilaginous articular surface. In the

8. Whitelocke, R. H. A.: Loose Bodies in the Knee, with Special Reference to their Etiology and Growth, *Brit. Jour. Surg.*, 1913-1914, 1, 650.

9. Koenig, F.: Ueber freie Körper in den Gelenken, *Deutsch. Ztschr. f. Chir.*, 1888, 27, 90.

10. Ridlon, John: Osteochondritis Dissecans, *THE JOURNAL A. M. A.*, Nov. 15, 1913, p. 1777.

11. Freiberg, A. H., and Wooley, P. G.: Osteochondritis Dissecans; Concerning Its Nature and Relation to Formation of Joint Mice, *Am. Jour. Orthop. Surg.*, 1910, 8, 477.

majority of instances no history is to be elicited of a tendency to form loose bodies, but there is a history of direct injury to the internal condyle of the femur by falling on the flexed knee. The injured area may be chipped off at the time, but more often the area of trauma is devitalized and later separates off and becomes a free body. In the greater number of our cases of loose bodies in the knee joint we were able to demonstrate either by the Roentgen ray or operation that the bodies originated from the thick ridge of the cartilage placed on the internal condyle of the femur to compensate for the wear caused by the normal action of the joint (Fig. 3).

The symptoms are catching or locking of the joint accompanied by pain and followed by swelling. Repeated attacks generally tend to decrease the severity of all the symptoms. Very often the patient is able to locate the body and thus establish the diagnosis. The Roentgen ray in practically all instances discloses the presence of the body, as the cartilage is usually dense enough to cast a shadow, and in many instances a small flake of bone is

attached to the cartilage which further aids in the localization. The continued presence of these bodies in a joint causes continued irritation and is apt to produce arthritis. They should be removed, therefore, but before operation care should be taken to locate them as accurately as possible. After the preparation of the knee has been completed, it may be possible to localize the body in the suprapatellar pouch or at either side of the ligamentum patellae. By holding the body between the fingers and infiltrating the skin with local anesthesia, a sharp needle may be pushed through the skin into the body to hold it securely. A small incision

down the course of the needle then allows ready removal of the body. More often, however, the body cannot be grasped in this manner and in such cases general anesthesia and an incision allowing the best approach to the body is necessary. If the body rests in the anterior compartment of the joint and on the inner side, the incision on the inner side of the patella permits the easiest entrance. When a more general exploration is necessary, the splitting of the patella as described by Corner¹² allows free inspection of the suprapatellar pouch and the anterior and inter-articular areas of the joint. If the body is posterior, the incision described by Brackett and Osgood¹³ through the popliteal space is the most convenient. The mere presence of a loose body in the posterior part of the joint does not demand its removal. Moreover, it should be remembered that occasionally there are sesamoid bones in the hamstrings that are

extremely difficult to differentiate. A sesamoid bone may have a concave surface that fits the convex posterior surface of the condyle of the femur, whereas the loose body, because of its wandering, does not have the shape of its location impressed on it, and is often rounded or oblong. Stereoscopic roentgenograms may show whether the body casting the shadow is resting directly on the condylar surface or is located in the intercondylar notch. If in the intercondylar notch, it is presumably a loose body, but if resting on the condyle it probably is a sesamoid.

FOREIGN BODIES

Foreign bodies cause derangements but differ from the previous groups mentioned in that they are of extrinsic origin, being introduced accidentally or intentionally from without. In the literature, needles are mentioned frequently as a finding. In some instances the patient is not aware of the introduction of the needle. Malingerers occasionally introduce needles in the knee joint, and the clinical picture is baffling until

a roentgenogram is taken. Bullets may enter the joint and be remarkably well tolerated. The presence of a foreign body in practically all instances demands the same operative measures as mentioned for the loose cartilaginous bodies, except that the demand for its removal is even more urgent.

SYNOVIAL FRINGES

Synovial fringes or fat tags occasionally cause mechanical derangements, but the symptoms are usually mild. The condition may be due to mild tuberculosis or to some systemic disease, such as syphilis. These facts, together with the mildness of the symptoms, usually contraindicate operative interference.

Such tags, as a rule, have their origin on the alar ligament or the fat pad extending on either side of the patellar ligament. Occasionally during the course of an exploration of the joint I have removed a pedunculated flattened fat tag which looked as though it were being habitually squeezed by the articular surfaces. However, that the fat tag may be the sole cause of joint derangement has not in our cases been shown to my satisfaction. Painter and Erving¹⁴ have called attention to the possibility that fat tags may cause symptoms, and have reported cases.

THE CRUCIAL LIGAMENTS

The results of rupture of one or both of the crucial ligaments are more serious and disabling than those of what are generally understood as mechanical derangements of the knee joint. Their cause is severe trauma, such as that resulting from the passing of a wagon wheel over the leg. If after an injury with the knee in an extended position the tibia can be pushed forward,

Fig. 2 (116019).—Anteroposterior view showing loose body at site of origin in internal condyle of the left femur.

12. Corner, E. M.: The Surgery of the Knee Joint, *THE JOURNAL A. M. A.*, Sept. 26, 1914, p. 1069.

13. Brackett, E. G., and Osgood, R. B.: The Popliteal Incision for the Removal of "Joint Mice" in the Posterior Capsule of the Knee Joint, *Boston Med. and Surg. Jour.*, 1911, **165**, 975.

14. Painter, C. F., and Erving, W. G.: Lipoma Arborescens, *Boston Med. and Surg. Jour.*, 1903, **168**, 305.

the anterior crucial is ruptured. If, with the knee in flexion, the tibia can be pushed backward, the posterior crucial is ruptured. The pain caused by such extensive manipulations usually necessitates an anesthetic. The spines of the tibia may be broken in addition, and occasionally give rise to loose bodies. For ruptured crucial ligaments, Corner has advised operative measures. However, when the knee is properly treated from the onset by placing it at rest in slight flexion in a plaster of Paris cast and maintaining such fixation for three months, a useful knee results. It is tersely stated by Jones and Smith¹⁵ that "modern practice pays not enough attention to the fact that a ruptured tendon or ligament must not be subjected to strain during the period of healing." Use of an injured knee should be permitted only after careful examination. According to these authors, in a case of rupture of both crucials, conservative measures of rest for three to six months promise better results than immediate operation. It is astonishing to what extent, particularly in the young, a knee with relaxed ligaments will regain stability if a suitable brace is provided to prevent strain on the stretched ligaments.

END-RESULTS

The cases forming the basis of this report number eighty-seven. They were all under observation in the Mayo Clinic during the interval between Jan. 1, 1910, and Jan. 1, 1916. As many of the patients as possible have been seen or communicated with since their operation, to ascertain the end-result of the treatment accorded them. There were sixty-three males and twenty-four females. The youngest was 14 years of age, and the oldest 67. The average age was 32 years.

The internal semilunar cartilage was judged to be the sole offender and removed in fifty-three cases. We were able to trace forty-four of these patients. Thirty were cured, nine were relieved, and five reported themselves as no better. It is probable that a few of the nine reporting themselves as merely relieved may be considered cured, for in some instances their reasons for stating that they were more or less dissatisfied with the operation were indefinite. However, as the opportunity to make the examinations and observations necessary to refute their statements was lacking, they have been classified as merely relieved. The five patients reported as no better were cases in which at operation no definite pathology could be established and the semilunar was removed on insufficient pathologic evidence. In the majority of these cases it would have been better to have at least deferred operation. Five patients we were unable to trace. The internal semilunar cartilages were removed from eight knees at the same time that loose bodies were removed. In the majority the loose bodies were the prime cause of the trouble. All of these patients reported themselves as completely cured. In twenty-four instances, loose bodies were removed from the knee joint when they were considered to be the chief offenders. Sixteen patients reported themselves as cured; five were not

traced, and three were relieved. The latter three cases were those of elderly people who had arthritis associated with the condition. Undoubtedly much of their present complaint is due to that.

Two cases of rupture of the crucial ligaments were treated conservatively by placing the knee slightly flexed in a plaster of Paris cast. Full function was restored.

To sum up, fifty-six of the eighty-seven patients operated on for mechanical derangements of the knee due to intrinsic causes were cured; twelve were relieved; five reported themselves as no better, and fourteen were not traced.

CONCLUSIONS

1. Damaged semilunar cartilages should be accorded the careful treatment by rest and fixation that is given an ordinary fracture of one of the long bones. Recurrent locking will then be an uncommon sequela.

2. Recurrent locking produced by a loose or fractured semilunar cartilage or loose body demands removal of the meniscus or body under the strictest asepsis. A judicial exploration of the joint should be made at the same time.

3. The condylar incision is the incision of choice for the removal of the semilunar cartilages.

4. For the removal of loose bodies, the split-patella incision is usually best.

5. A ruptured crucial ligament is better treated conservatively than by operation.

ABSTRACT OF DISCUSSION

DR. JOHN RIDLON, Chicago: I agree entirely with all that Dr. Henderson said, but I would like to say that in injuries of the knee joint in which the semilunar cartilage may have been injured, it is most important to put the leg straight in a plaster cast and keep it there until all symptoms have been absent for a long time. If symptoms return without there having been an accident, it is necessary to go into the

joint, unless some reason otherwise is shown. I think that we are going to find a lot more cases of osteochondritis dissecans than heretofore. When I published my paper I reported three cases. Before that Dr. Freiberg's case was the first, and I think the only one in this country; and my three were the next. The cases are not common. Dr. Henderson has been able to show a number, probably because he knew what to look for. We have had an unusual case since the publication of my paper. A young woman presented the typical Roentgen-ray pictures of osteochondritis dissecans in both knees. On opening the right knee we found the cartilage of the inner condyle blistered up, but no loose body. In the left knee we found the cartilage in the same condition and a loose body, biscuit-shaped, $1\frac{1}{8}$ inch in circumference and one-fourth inch thick. This was removed. A year later the Roentgen-ray pictures showed a loose body in the right knee, another spot of osteochondritis dissecans in the left knee and another loose body in that joint.

DR. J. P. LORD, Omaha: About twelve or fifteen years ago Dr. W. J. Mayo called attention to the advantages of a transverse incision of the knee for extreme infections of the knee joint. Having had experience in opening the knee thus freely with very desirable results, and regarding it as not of serious consequence, I used this method of exposure in one case with highly gratifying results in which the patellar tendon was divided and the knee joint widely opened, which enabled me with great facility to remove the foreign bodies.

Fig. 3 (147988).—Cross section of loose body, showing cartilage grown around the bone, $\times 2\frac{1}{4}$.

15. Jones, R., and Smith, S. A.: On Rupture of the Crucial Ligaments of the Knee, and on Fractures of the Spine of the Tibia, *Brit. Jour. Surg.*, 1913-1914, 1, 70.

They were very large and eight in number, one being nearly 2 inches in extent, and of a mulberry type. Part of these bodies were well behind the condyles, and it had seemed to me that no other incision would have been adequate to have made an assured success of their removal without, perhaps, more exposure and damage than there was in the very radical procedure of opening the joint in the manner described. I do not pretend to say that this is very often indicated.

DR. W. C. CAMPBELL, Memphis, Tenn.: Dr. Henderson stated that he has not removed a single external cartilage during all the series. A few days before I left I removed the external cartilage from a man who gave a very interesting history. He had three days previously a sudden locking of the knee, which had caught at a greater angle than I had ever seen. It was fixed and held at a right angle. Six or eight years before, he had had a number of attacks, and then, without treatment, they had stopped, and he has had no trouble for three years. He had always before been able to straighten the knee after a few hours. This time, however, he was unable to do so. He was brought to me with the knee flexed at about a right angle and fixed in that position. I insisted on taking him to the hospital and doing an operation to get the leg down, if he could not reduce it otherwise. He refused treatment or operation, so he went home and stayed there ten days. Then he came back with no improvement in his condition. There was practically no effusion in the joint when the joint was opened. The knee was freely movable in flexion beyond the point of locking. On operation, I found that the external cartilage was so long that it was folded on itself in the joint. I removed it by the usual external incision.

DR. ROBERT B. OSGOOD, Boston: I agree in the main with Dr. Henderson, but I think that it is a mistake to consider this semilunar cartilage problem a simple one or to be dogmatic about the operation. I understood him to say that we should take three fifths of the cartilage away. I am not sure that that dictum is wise, because I have seen certain cases in which perhaps three fifths have been removed, and in which the symptoms of slipping did not return; but the symptoms of riding up over the end of the cartilage left did occur, and seemed to be overcome by an operation which secondarily removed the posterior portion of the cartilage. More than that, cartilages are often found, in my experience, not simply detached in their anterior portion, but sometimes quite extensively detached along their whole border. The flopping inward and outward gives rise to the symptoms. It would be, in such cases, obviously unwise to remove simply the anterior portion. They are sometimes split longitudinally as if cut with a knife from one end to the other. I have found this a number of times, the internal, or joint, side being free, and the other side attached to the coronary ligament. It would obviously be unwise to remove simply the anterior two thirds in such a case as that. These are problems which demand an exposure of the whole site and the condylar incision, which Dr. Henderson advises is the best. I take him to mean an incision that is longitudinal in its upper portion and then sweeps backward at the level of the joint line. At the Massachusetts General Hospital clinic during the last year we have had two cases of external cartilage, as well as internal.

DR. EDWIN W. RYERSON, Chicago: Dr. Osgood's point about the removal of the whole cartilage is excellent. If you are going to remove any, why not take out the whole thing? The operation is easier with the leg flexed at a right angle on the edge of the table. Then the leg can be rotated around, so as to reach the posterior end of the cartilage. The anterior end can always be removed easily. The other end can be snipped off with a pair of strong curved scissors. Loose bodies are sometimes extremely annoying. If you get into the joint without having first transfixed the loose body, you sometimes cannot find it even with a wide opening. It is possible to take it out under local anesthesia in most cases. In one case in which I was operating under a local anesthetic I could not find the loose body, which was as large as the end of the thumb. The man said, "I can find it for you"; so we put a pair of sterile rubber gloves on his hands, and in a minute he squeezed out the loose body, which flew on to the floor. Another point about the transverse incision is useful.

Do not make too long an internal incision. I saw an incision 7 inches long made by a surgeon in Chicago. It is only necessary to make a short incision, the perpendicular part being an inch and a half long, and the transverse part about 2 inches, as described by Robert Jones. I want to report another case of external semilunar cartilage fracture caused by a man being struck by the lower step of a train. It made a great deal of trouble for the patient until the cartilage was removed.

DR. J. T. WATKINS, San Francisco: I understood Dr. Henderson to say that he would not operate when the rupture of a semilunar cartilage occurred the first time. I think it would be right to qualify that statement according to the occupation of the individual. For instance, twice during the last year, once in a painter and once in a carpenter, I had to attack the semilunar immediately. I felt that I could not send the man up on a scaffolding with the knee in that condition, because a recurrence might mean his death by a fall. Mr. Jones, in his classical monograph, warns us that we may find all the symptoms at the inner or the outer side of the point only to find at operation that the other was the one involved. I had that experience last winter. I went in and found that the semilunar on the side where the patient gave all the classical symptoms was as good as any one's, and then discovered that the cartilage of the other side was the torn one.

DR. MELVIN S. HENDERSON, Rochester, Minn.: Dr. Lord mentioned the transverse incision. I have not used it except in resections of the joints, but see no reason why with proper care, avoiding the lateral ligaments, it should not be used in cases such as Dr. Lord speaks of. Dr. Campbell has mentioned the damage to the external semilunar cartilage. To me this is very interesting because in our series we have not had such a case. It may be that we have overlooked the condition in some of our cases. Dr. Osgood's criticism is a just one—in the part of the paper I have read I have not mentioned much about the internal semilunar cartilage as I found it necessary to reduce the paper in order to read it in the allotted time. Some of the points mentioned by Dr. Osgood have been taken up in the fore part of the paper. I believe that the removal of the anterior three fifths of the semilunar cartilage in the majority of cases is sufficient. Of course, if the fracture is further back it must be removed back of the fracture. One reason for advocating this is that a larger incision is necessary to remove the entire cartilage, and in using the larger incision one is apt to damage the internal lateral ligaments and it is best to avoid this as much as possible. Dr. Watkins mentioned not operating the first time the derangement occurred. If the reduction cannot be accomplished otherwise, of course, operation is necessary. Such a case was that mentioned by Dr. Campbell in which he was unable to reduce the dislocation and found it necessary to remove the external semilunar cartilage in order to straighten the leg.

Food Values and Appetite.—Not all food materials are valuable in proportion to the appeal which they make to the appetite. For example, the flavor substances in foods which stimulate the olfactory and gustatory nerves, and thus give rise to appetite, are not ordinarily the substances on which the body depends for its fuel, nor for the great bulk of its building materials. The latter materials—proteins, fats or oils, and carbohydrates—when chemically pure, have little or no taste or smell. The preference for thin and crisp rather than greasy bacon is an illustration. In a recent experiment it was found that of the 129 calories which represented the fuel value of a very thin 20 gm. (three-fourths ounce) slice, only nine calories remained when the slice was sent to the table; 120 calories being represented by the fat which "fried out" into the pan. In this case a considerable amount of flavor body also goes into the fat, yet most persons would not consider eating it unless it has been skilfully blended with large quantities of other foods; whereas the scrap of skeleton tissue which has lost 93 per cent. of its food value is a dainty morsel.—Minna C. Denton, *Scientific Monthly*, December, 1916.