

INTERNAL DERANGEMENT OF THE KNEE

BY

P. E. GIERTSEN

Oslo

As far back as 1731 Blasius mentions the peculiarity, that when a knee has been distorted, pathological symptoms may occur following such small injuries as have no effect upon the normal knee.

He created the diagnosis »dérangement interne« which only says that there is something wrong inside the knee joint.

The honour of having enlarged our knowledge by describing the dislocation of the menisci is ascribed to Bruns (though it is already mentioned in Tillmann's text book of surgery in 1888).

Examination of knee joints operated upon, however, revealed that also other injuries, such as fractures of the menisci may occur, and in »Nordisk Lærebog for Kirurgi« 1920 Chievitz speaks of lesions and not of dislocation of the menisci. Chievitz writes: »The lesion which is as a rule called dislocation of the menisci is of no small practical importance. In many cases the right diagnosis is fairly easy to make, but in other cases we must confine ourselves to the diagnosis of internal dérangement«. The internal ligamentous apparatus of the knee, the cruciate ligaments, are but mentioned briefly in this connection. Chievitz describes detachment of the cruciate ligaments as »another form of distortion, which as a rule cannot be diagnosed«. In the surgical text books we find suture after rupture of the ligaments mentioned.

An important symptom for the diagnosis of rupture is the so-called »drawer« symptom: if the leg be allowed to hang

down freely at 90° flexion, it is possible to move the tibia backwards and forwards against the femur like the drawer of a table. But in this connection distortion of the cruciate ligaments is not mentioned.

We know from anatomy that these ligaments are very strong. The medial ligament is attached behind the lateral one to the intercondyloid eminence of the tibia. The lateral ligament passes obliquely backwards and laterally to the medial non-articular surface of the lateral condyle, where it finds attachment in the intercondyloid notch. Its attachment to the tibia is closely connected with the lateral semilunar cartilage. The posterior ligament is somewhat shorter and stronger than the preceding; it passes proximally nearly vertically, and is inserted into the medial condyle, far forwards towards the anterior margin of the intercondyloid notch. The tibial attachment of the posterior ligament is not so closely connected with the medial semilunar cartilage, as is the attachment of the lateral ligament to the lateral semilunar cartilage.

Already 80 years ago the anatomist Hyrtl emphasized the importance of the cruciate ligaments, and in post-mortem experiments he analyzed their function by cutting them through, whilst he left the remainder of the ligamentous apparatus intact. He found that during extension the stability of the joint was not impaired because of the fibular and tibial collateral ligaments. During flexion, however, the connection between the tibia and femur became loose and faltering.

He now tried to cut the collateral ligaments, leaving the cruciate ligaments intact. There was now a certain stability of the joint when fully extended, first of all on account of tension of the posterior cruciate ligament. This was also the case when the knee was fully flexed on account of tension of the anterior ligament. The posterior ligament was more tense than the anterior.

He then cut all the ligaments of the joint with exception of the cruciate ligaments, suspended the leg and loaded it with weights to the point of bursting. The ligaments, however, did not burst, but their attachments loosened, first that of the posterior ligament.

In *Deutsche Zeitschrift für Chirurgie* 1893 the Austrian military surgeon *Hönigschmied* has published systematic experiments on post-mortem loading of the large joints, investigating the bursting of the ligaments.

Regarding the knee-joint he concluded as follows:

1) Loading beyond the limits of elasticity in older individuals produced fractures of the bones, whilst in younger individuals lesions of the ligaments, as a rule loosening of the attachment, or more seldom, rupture of the ligaments, occurred.

2) Excessive extension produced loosening of the attachment of the cruciate ligaments. The anterior ligament was detached from the tibia, the posterior from the femur. Moreover, loosening of the semilunar cartilages might occur. More seldom the fibular collateral ligament was detached from the femur.

3) Excessive flexion produced detachment of the anterior cruciate ligament from the femur.

4) Excessive adduction produced rupture of the ligaments inserted into the external condyle, detachment of the anterior cruciate ligament, and later detachment of the posterior cruciate ligament.

5) Excessive abduction: Detachment of the collateral tibial ligament, of the posterior cruciate ligament, and lastly of the anterior cruciate ligament.

6) Excessive pronation: rupture of the fibrous capsule, detachment of the insertion of the anterior cruciate ligament, partly from the tibia, partly from the femur. The posterior cruciate ligament always remained intact.

7) Excessive supination: The posterior cruciate ligament detached from the tibia (once combined with segregation of a small piece of the bone), detachment of the anterior cruciate ligament, partly from the tibia, partly from the femur. Fairly frequently the medial semilunar cartilage was loosened, never the lateral.

The results are somewhat surprising compared with the anatomy of the joint. The cruciate ligaments are considered to

act as internal collateral ligaments, chiefly preventing ab- and adduction.

In an anatomical preparation in which the capsule has been cut through, but the cruciate ligaments preserved, it is possible to supine the tibia almost 360°, the cruciate ligaments being twisted from one another. Pronation takes place to a lesser degree, the cruciate ligaments now being twisted round one another. On the same preparation it may also be observed that the cruciate ligaments are tightened and prevent ab- and adduction.

These experiments are of special interest as regards internal derangement, as this phenomenon occurs as a result of distortion of the knee joint, similar to the movements produced in the experiments. These experiments therefore have bearing on our knowledge of injuries to the knee.

It is of special interest that distortion of the knee produces both lesions of the menisci and of the cruciate ligaments, and that the latter phenomenon does not consist in a rupture of the ligaments, but in a detachment, often accompanied by sequestration of the bone.

Further it is interesting, that excessive adduction and pronation causes lesion of the lateral, excessive abduction and supination lesion of the medial cruciate ligament.

The football bears the first prize for producing lesions of the knee (if a sporting term may be allowed). We also use the term »football« knee, analogous to the term »tennis-calf«, which lesion is due to rupture of the muscles of the calf. There is also evidence that it is justifiable to use the term »skiing« knee for internal derangement due to lesions of the cruciate ligaments.

When skiing one may fall in many ways, and most often the knees are hurt. A special lesion of the knee is typical, at

any rate for the more capable ski-runner. When speeding on the skis the knees are always slightly flexed. If the point of the ski is caught in the snow, the ski acts as the long arm of a lever, which with great force abducts and supines the flexed knee—just the mechanism which according to Hönigschmied acts upon the medial cruciate ligament. It is of significance that the individuals in question often are in good training and possess strong bones and powerful ligaments, because of which the lesion often becomes more localized than in the untrained individual.

The clinical picture may be more or less pronounced. Shock with cold sweat, unconsciousness and fainting is often seen, likewise immediate pain of varying intensity. The patient often hears a crack or feels something burst in the knee. With care he may be able to continue skiing, but in the course of the day exsudation usually appears in the joint, and the first night is uncomfortable: he cannot sleep on account of pain and difficulty in finding a position in which he can rest his knee. After a short time the symptoms begin to disappear, the patient leaves his bed and is able to walk quite well with a slight limp on the floor or on the pavement. Each little roughness, however, claims the greatest caution, as the slightest side movement may cause such pain that he has to rest for some minutes.

Examination at this time as a rule reveals exsudation in the joint, tenderness along the line of the joint, corresponding to the medial meniscus. I have never been able to demonstrate the so-called »drawer« symptom, but another symptom may be found, which is fairly pathognomic: if the leg is allowed to hang loosely, passive supination will cause severe pain. I have always found this symptom together with the development of severe pain upon passive stretching of the extended knee. The symptom disappears little by little, and it is not found in common traumatic hydrops of the joint. In some few cases the above mentioned soreness and impairment of the extension have been the only symptoms.

As the pain is caused exactly by the movements which according to Hyrtl and Hönigschmied's experiments stretch the

medial cruciate ligament, this must be considered a proof that a lesion of the cruciate ligament has taken place. This of course does not exclude the possibility of a simultaneous lesion of the menisci. But if the accident is not followed by dislocation of the menisci or locking of the joint, the lesion of the cruciate ligament is the essential part of the disease, and according to the above mentioned post-mortem experiment, it must be considered to consist in loosening of the attachment, often combined with segregation of the bone.

In 1934 I treated a case which seems to through some light on lesions of the cruciate ligaments.

On the 5th of May 1934 a 26 year old sailor jumped on his right leg from the deck on to a hatch, the tarpawling of the hatch was wet, and on this rubber slips as if in a well greased bearing. His knee was bent and slipped laterally. He heard a crack in the knee and had a feeling that something was dislocated in the joint. He made a rotation movement to put it in order, which at once caused severe pain in the knee and cold perspiration. He sat for a while on the hatch, got hold of a stick and hobbled to bed. He was in bed for a week and a half; his knee became considerably swollen. On May the 18th he was able to do some work; he could walk with his knee moderately flexed, but he was not able to stretch it. On May the 25th he consulted a doctor in Panama; the doctor found a hydrops in the joint. He worked until June 13th, when a doctor in San Pedro emptied the fluid from the joint; after this he was in bed for 4 days and then he worked until the ship arrived in Oslo on August 11th.

On his arrival there was a small quantity of fluid in the joint, the capsule was not swollen, the articular line was tender corresponding to the medial condyle, 2 cm.'s atrophy of the muscles of the femur. He could flex the knee about 70°, extension was slightly impaired. Excessive passive extension caused pain, also passive supination of the flexed knee, but not pronation; there was no »drawer« symptom.

X-ray examination (Dr. Werenskjold): »Diffuse and spotted osteoporosis, mostly around the intercondyloid eminence and the intercondyloid notch. The outline of the medial intercondyloid eminence is not distinct, its chalk content being reduced, so that it is impossible to distinguish its limits and summit. There is no definite line of fracture. The width of the cartilage is normal, the capsule not swollen.

The x-ray thus revealed osteoporosis, most pronounced around the attachments of the cruciate ligaments, which may indicate partial or total detachment or perhaps lesion of the menisci.«

In February 1935 it was hardly possible to demonstrate fluid in the knee; there was 1 cm.'s atrophy of the femur muscles. He complained of instability and weakness in the joint, as he was only able to walk with ease on a smooth road, but had to be very careful otherwise. When standing erect he had to use the muscles of his right leg, as he could not extend the right knee completely.

On May the 14th it was just possible to demonstrate fluid in the knee. The circumference of the femur 1 cm. reduced. The movements in the knee joint were complete and painless, the pains on hyperextension, pronation and supination having disappeared. Slight crepitation in the knee when extended against resistance. He was able to rest on the right leg, but after a short time pain developed on the anterior side of the joint. He was able to walk freely, also where the ground was rough, but in this case he had to be careful where he placed his foot, or he might suddenly feel immobilized after movements which supined the knee joint. When walking down-hill his right leg felt weaker than the left.

The x-ray now revealed osteoporosis corresponding to the attachments of the cruciate ligaments, otherwise nothing abnormal.

Re-examination on Sept. 25th 1935 showed: normal aspect of the right knee, 1 cm.'s atrophy of the muscles of the femur; extension slightly reduced. No pain on passive hyperextension. May be a slight pain corresponding to the medial meniscus

during supination, but no tenderness. He does not limp, but he does not feel safe on a rough road, as he dare not rely upon the knee during abduction or supination.

X-ray examination: »The previously observed osteoporosis round the intercondyloid eminence and intercondyloid notch is not seen with certainty. The outlines of the femur and tibia smooth, without deposits. At the lower border of the patella a beak-shaped osteophyte. The width of the cartilage normal. The capsule not distended.«

This case is of an interest an example of a very severe internal derangement, with a sudden and intense reaction on the part of the knee, causing pain, shock and large hydrops, followed by impairment of the function of long duration. It must be emphasized that symptoms of lesions of the menisci were not demonstrated, whilst definite symptoms of reduced function of the cruciate ligaments were found: lack of extension, instability during flexion, pain on all movements that extend the medial cruciate ligament. The x-ray spoke strongly in favour of a lesion of the attachment of the ligaments.

The accident caused the patient to be unable to work for a long times.

The case revealed an internal dérangement with lesion of the cruciate ligaments. It seems justifiable to assume that such lesions are not so very seldom, occurring either as an isolated phenomenon or together with lesions of the menisci.

Post-mortem experiments and x-ray examinations both show that lesions of the ligaments most often occur as loosening of the attachments, in other words, the lesion is not a fracture in the usual sense of the word, but what may be called a »fractiola« accompanied by impairment of the bone (viz. the osteoporosis around the attachments of the ligaments in the above case).

It is therefore worth considering, whether more severe injuries of the joints ought not to be treated more in accordance with the principles of the treatment of fractures: immobilisation, taken in the broadest sense of the word, keeping the patient in bed, plaster or ordinary bandage, or prohibition against all movements that may extend the injured ligaments.

If in the case in question a plaster bandage had been used from the very beginning, the patient would have been able to work again after a considerably shorter period.

It is the general opinion that immobilisation may be dangerous in two aspects: in producing a so-called atrophy due to inactivity, and in causing a stiff joint.

The adjective »so-called« refers to the opinion taught me by my teacher of neurology: that atrophy accompanying a diseased joint is due to a reflex from the joint, which is maintained or increased by painful treatment.

It is necessary to distinguish weakness of the locomotor system due to protracted confinement in bed from the typical atrophy of the muscles proximal to an injured joint.

A protracted confinement in bed results in stiffness and pains in the ligaments and joints. This, however, is a general symptom and will disappear after a short while, and it is quite different from the located often very pronounced atrophy of the muscles, ligaments and bones.

E.g. two cases of lesion of the menisci are operated upon in the same manner, both are kept in bed, lying inactive with their lower extremities; in none of the cases are there any complications. One case develops pronounced atrophy of the femoral muscles, in the other case there is no atrophy.

We find a similar phenomenon in the atrophy of the deltoid muscle which so often follows a lesion of the shoulder: as long as the massage is accompanied by forceful movements, tending to mobilise the joint, it brings little progress. But if the passive movements are abandoned, and the patient himself is made to

carry out pendulous movements or more adequate movements, the muscles begin to recover. Neither is it reasonable to say an atrophy is due to inactivity, if the joint be not perfectly immobilized.

Manipulations causing pain to the injured knee, intensify the atrophy, and in this connection it is justifiable to speak of »activity-atrophy«.

Stiffness of the joint is also feared. Experience has always taught me, that the mobility which may be obtained in a joint after an injury, may be obtained without breaking it with force, and I therefore believed that this useless and cruel procedure had been given up by all doctors, even though the very ardent massagists cannot let it alone; but in November 1932 a sorrowful mother consulted me with her son. 2 months previously the boy had fractured his medial humeral condyle. The fracture had healed with a slight dislocation, and a mobility of 110°—140°, though the mother every day had taken the crying boy to be massaged. The doctor had prescribed intense treatment, and this had been carried out so literally that the boy's psychical condition was absolutely shattered, every unexpected impression frightened him and he cried for nothing, but the joint was equally stiff.

Massage was now abandoned, and the joint left alone. In February 1933 there was a mobility of 85°—145°, and on May the 18th 1935 the mobility of the joint was normal.

This is one of many cases that have proved to me that the mobility which may be obtained is achieved without breaking the joint.

The principle of the treatment of injured joints may be expressed in a paradox; which however must not be taken literally, and not only »cum grano salis« but with more than that: »The best mobilization treatment of an injured joint is immobilization«.

RÉSUMÉ

Le diagnostic »dérangement interne du genou« qui indique seulement qu'il y a quelquechose d'anormal à l'intérieur du genou fut appliqué la première fois, en 1731, par *Blasius*. En 1892, *Bruns* approfondit les connaissances que l'on avait en démontrant les luxations des ménisques. Plus tard, on a aussi trouvé d'autres lésions des ménisques. Par contre, il a été très peu parlé des accidents de l'autre ligament interne, le ligamente cruciata (exception faite des déchirures avec le symptôme si caractéristique »Skuffsymptom« et d'autres symptômes prononcés).

Hyrtil fit, il y a déjà 80 ans, des recherches sur les cadavres et trouva que les ligaments, notamment dans les flexions, rend la jointure entre le tibia et le fémur stö. Si les ligaments sont chargés jusqu'à rupture, il ne se produit généralement pas de déchirure, mais un détachement de la partie rattachée à l'os.

Dans le »*Deutsche Zeitschrift für Chirurgie*«, le médecin militaire autrichien *Hönigschmied* publia, en 1893, des expériences systématiques effectuées sur des cadavres afin d'étudier les lésions des grosses articulations, causées par surcharge.

En ce qui concerne les genoux, il trouva que les hyperabductions et hypersupinations, notamment, nuisent aux ligaments.

On signale que tout comme on parle du »genou du joueur de foot-ball« (lésions des ménisques), on peut parler du »genou du skieur« (lésions des ligamenta cruciata). En cours de route, lorsque le skieur a les genoux légèrement pliés, le bout du ski peut s'accrocher aux rebords de neige et les genoux sont soumis à une abduction et à une supination extrêmement violentes. Les symptômes décrits rappellent les lésions des ménisques, qui peuvent d'ailleurs se produire simultanément; toutefois, la plupart du temps, il n'y a aucun symptôme de ce genre. Il y a généralement (mais pas toujours) de l'hydarthrus, des douleurs pendant un ou deux jours. Plus tard, faiblesse dans l'articulation, de sorte que le malade boîte et ne peut marcher que sur un chemin plat. Tout mouvement de côté, toute flexion, provoquent des douleurs et le genou ne peut être complètement tendu.

Objectivement, on ne trouve pas le »Skuffsymptôm« mais une flexion passive de l'articulation du genou, la jambe pendante, provoque des douleurs dans le genou. Ce symptôme et la douleur provoquée par l'hyperextension passive semblent caractériser les lésions du ligamenta cruciata, car on ne les voit pas dans l'hydarthrus traumatique non compliquée, tout comme il diminue au fur et à mesure de l'amélioration.

Il est décrit un cas, un dérangement violent avec longue période d'invalidité et de faiblesse du genou. La radiographie montre une ostéoporose de l'eminentiae intercondyloideae, qui a toutefois complètement disparu une année après l'accident.

Les expériences cliniques et les recherches effectuées sur les cadavres prouvant que les lésions des articulations sont souvent accompagnées de lésions des ligaments, qui se détachent notamment du point de fixation, l'auteur estime que l'on devrait, dans les lésions des articulations, montrer plus d'attention au traitement par l'immobilisation.

Il estime que ce qu'on appelle »l'atrophie d'inactivité« est une sorte d'atrophie réflexe qui se maintient du fait que toutes les manipulations de l'articulation malade augmentent l'atrophie; on pourrait peut-être parler ici d'»atrophie d'activité«.

La raideur de l'articulation après l'immobilisation — si elle n'est pas due à des modifications anatomiques — apparaît »sans rupture«. On pourrait dire, bien que cela puisse sembler paradoxal que »le meilleur traitement mobilisateur d'une articulation malade est l'immobilisation.«

SUMMARY

The diagnosis »dérangement interne du genou«, which merely indicates that something is wrong inside the knee-joint, was first used by *Blasius* 1731, and in 1892 *Bruns* enlarged our knowledge of the affection by describing the dislocation of the semilunar cartilages. Injuries to the other ligamentous apparatus—the cruciate ligaments—are, however, seldom men-

tioned (excepting ruptures with the characteristic »drawer-symptom« and other pronounced symptoms).

Already 80 years ago *Hyrtl* made postmortem experiments and found that the cruciate ligaments—especially when the knee was flexed—determined the stability of the connection between the tibia and the femur. If the ligaments are loaded to the point of rupture, the result is generally not at bursting of the ligaments, but loosening of their osseous attachments.

In »*Deutsche Zeitschrift für Chirurgie*« the Austrian Military Surgeon *Hönigschmied* in 1893 published systematic post-mortem experiments in which he had studied the injurious effect of overloading the big joints.

Regarding the knee joint he found that especially excessive abduction and excessive supination caused lesions of the cruciate ligaments.

The idea is put forth that analogous to the term »football-knee« (lesion of the menisci), it is justifiable to speak of a »skiing-knee« (lesion of the cruciate ligaments). When speeding with slightly flexed knees, the point of the ski may be caught in the snow and the knee is abducted and supined with great force the symptoms are described, they are similar to those of lesions of the menisci, which may also occur simultaneously, but often every symptom of lesion of the menisci has vanished later on in the disease. Most often (but not always) hydrops develops; pains for some days. Later on the knee is weak, the patient walking with a slight limp and only on a smooth road. Any side movement or rotation causes pain, and the patient cannot fully stretch the knee.

Examination does not reveal any »drawer-symptom«, but if the leg is allowed to hang down loosely passive supination of the knee causes pain in the joint. This symptom together with pain on passive hyperextension seems characteristic of lesions of the cruciate ligaments, as it is not present in cases of non-traumatic hydrops, and it recedes as the knee recovers.

A case is described of severe derangement, the patient being invalided for a long time with weakness of the knee of long duration. X-ray examination revealed osteoporosis of the in-

tercondyloid eminence, which, however, could no longer be detected about a year after the accident.

As both clinical experience and post-mortem experiments show that injuries to the joints often cause lesions of the ligaments, and that the lesions often consist in loosening of their attachments, the author is of opinion that immobilisation treatment ought to be considered more often than is now the case.

The author thinks that the »so-called« atrophy due to inactivity should be interpreted as a reflex-atrophy, which is kept going by all manipulations causing pain, the latter thus causing an »activity-atrophy«.

Stiffness of a joint after immobilisation—as far as it is not due to anatomical changes—may be cured without »breaking«.

Speaking in a paradox, one may say: »the best mobilisation treatment of a joint is immobilisation.«

ZUSAMMENFASSUNG

Die Diagnose »Dérangement interne du genou«, die nur ausdrückt, dass im Innern des Kniegelenks etwas nicht in Ordnung ist, wurde zuerst 1731 von *Blasius* verwendet, und *Bruns* hat 1892 unsere Kenntnis hiervon dadurch vertieft, dass er die Meniscusluxation nachwies. Später hat man noch andere Schäden an den Meniscen gefunden. Die Schäden des anderen inneren Bandapparates, der *ligamenta cruciata*, (abgesehen von der Zerreißung mit ihrem charakteristischen »Schubladensymptom« und anderen prägnanten Symptomen) werden dagegen nur wenig besprochen.

Hyrtl hat bereits vor 80 Jahren Experimente an der Leiche vorgenommen und gefunden, dass die Kreuzbänder, insbesondere in gebeugter Stellung, die Verbindung zwischen tibia und femur stabilisieren. Wenn sie übermäßig belastet werden, tritt im allgemeinen keine Zerreißung ein, sondern eine Ablösung von den Ansatzstellen an den Knochen.

In der Deutschen Zeitschrift für Chirurgie veröffentlicht der österreichische Regimentsarzt Hönigschmied 1893 einige syste-

matische Versuche an der Leiche zwecks Studiums der Schäden bei Überbelastung in den grossen Gelenken.

Beim Kniegelenk findet er, dass insbesondere eine Hyperabduktion und eine Hypersuspension den Kreuzbändern schadet.

Es wird angeführt, dass man in Anlehnung an das »Fussballknie« (Meniscusschaden) von einem »Skiknie« sprechen kann (Schaden der ligamenta cruciata). Bei der Fahrt mit leicht gebeugten Knien kann die Skispitze in einer Schneespur wegrutschen, das Knie wird dann mit grosser Kraft abduziert und supiniert.

Die Symptome werden beschrieben, sie gleichen dem Bilde bei Meniscusschäden, was gleichzeitig vorkommen kann, oft aber bleibt jedes spätere Symptom davon aus. Meist (doch nicht immer) kommt es zu Hydarthros und ein paar Tagen Schmerzen. Später entwickelt sich eine Schwäche, so dass der Patient hinkt und nur schlecht gehen kann. Jede seitliche Bewegung oder Drehung löst Schmerz aus, und das Knie kann nicht ganz gestreckt werden.

Objektiv findet sich kein »Schubladensymptom«, aber die passive Drehung des Kniegelenkes mit hängendem Unterschenkel löst einen Schmerz im Knie aus. Dieses Symptom scheint zusammen mit Schmerz bei passiver Hyperextension charakteristisch zu sein für einen Schaden an den ligamenta cruciata, da es bei unkompliziertem traumatischen Hydarthros fehlt, wie es auch mit der allmählichen Heilung des Schadens abnimmt.

Es wird ein Fall beschrieben, ein heftiges dérangement mit langer Invalidität, langwieriger Schwäche im Knie. Durch Röntgenuntersuchung wurde eine Osteoporose der eminentiae intercondyloideae nachgewiesen, was aber ungefähr 1 Jahr nach der Beschädigung nicht mehr nachzuweisen war.

Da sowohl die klinischen Erfahrungen wie die Experimente an der Leiche zeigen, dass bei Gelenkschäden oft ein Schaden der Ligamente vorliegt, und dass solche Schäden der Ligamente meist in einer Ablösung von ihren Ansatzpunkten bestehen, meint der Verfasser, dass man bei Gelenkschäden der Immobilisierung grössere Aufmerksamkeit schenken müsste.

Die sog. »Inaktivitätsatrophie« ist seiner Ansicht nach als

eine Reflexatrophie aufzufassen, die durch alle schmerzenden Manipulationen an dem beschädigten Gelenk weiterhin aufrechterhalten wird, die die Atrophie also noch verstärken, so dass man in dieser Verbindung von einer »Aktivitätsatrophie« sprechen könnte.

Steifheit eines Gelenkes nach Immobilisierung — soweit sie nicht auf anatomischen Veränderungen beruht — entsteht ohne Komplikationen.

Man kann das Paradoxon aussprechen: »Die beste mobilisierende Behandlung eines beschädigten Gelenkes ist die Immobilisierung.«