Erasion (arthrectomy) in diseases of the joints / by De Forest Willard.

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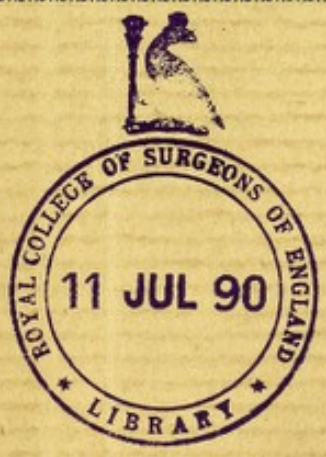

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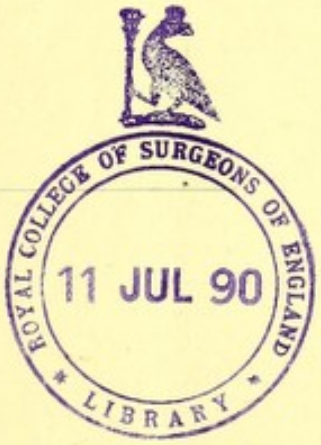

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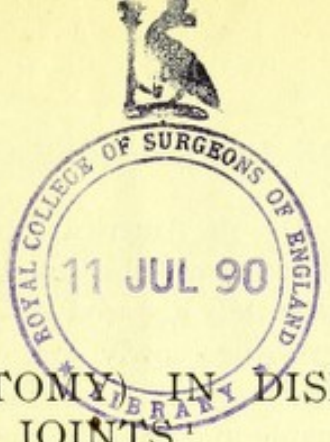

ERASION (ARTHRECTOMY) IN DISEASES OF THE JOINTS.[1]

By De Forest Willard, M.D., Ph.D.,

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Erasion, as the term is properly applied in joint surgery, signifies the free exposure and exploration of an articulation and the thorough extirpation of all the diseased tissues either of hard or soft parts. The synovial membrane, the cartilages, the ligaments and all the tuberculous foci in the bone in the immediate neighborhood of the joint are included in this eradication.

Excision is a more extensive extirpation, including the removal of larger portions of the osseous tissues; but in excision much healthy bone is removed, and some of the diseased soft tissues are often left behind.

The term erasion, from *eradere*, to scrape out, seems to express most thoroughly the actual form of operation; and the term arthrectomy, which is so frequently employed, is properly objected to by many writers, since it applies more strictly to true excision. It is unfortunate that the word arthrectomy has crept into use, since we are endeavoring in our literature to differentiate between "ectomy," to cut out, and "otomy," to cut into.

It is urged by some that the term arthrectomy is proper since it implies the cutting out of the soft tissues of the joints, but the operation means more than this; it includes, as has been said, the removal of foci of diseased bone, whenever the involvement is not too extensive. It is argued that the term arthrectomy is not applicable to excision from the fact that in the latter operation we remove more than the joint. This is true in certain cases, while in others we remove just so much as is necessary to include the diseased foci. The word arthrotomy, which has been proposed, is obviously inappropriate, since the operation contemplates decidedly more than simple incision into the joint. A notable instance of the inappropriateness of nomenclature is seen in the word ovariotomy. It is wise in proposing new terms to use those which are scientifically correct when it is possible to do so.

Erasion, it seems to me, expresses most thoroughly the condition of scraping and cleaning away of diseased tissues; and scraping and extirpation are certainly the essential elements in the plan proposed by erasion.

Gouging and cutting away diseased tissues (abrasion, arthroxesis) have long been practised in joint surgery, but the dignification of the procedures into the formal operation termed erasion is due to Wright, of Manchester, in 1881, since which time it has slowly and steadily increased in favor, especially in

[1] Read by invitation at the Annual Meeting of the Philadelphia Academy of Surgery.

Germany, and, more recently, in America. In France it has not met with much favor. It is not offered as a substitute for excision, but it is applicable to a certain number of moderately diseased cases, especially in young children, where the disease is progressing slowly, and where the evidence of joint destruction is not sufficient to warrant the average surgeon in resorting to excision. It is especially valuable in cases of pulpy and gelatiniform degeneration, where the involvement of bone is apparently moderate in degree; and also in cases where the tuberculous condition gives no evidence of being other than local in its character. Where there are evidences of general tubercular infection such an operation must necessarily be insufficient. Since the recognition of the bacillus tuberculosis by Koch, in 1882, much impetus has been given to the question of the possibility of the removal of tubercle while it is only a local condition, and before the general involvement of the constitution takes place. There are many who still employ the old word scrofulosis, and, when the term is used intelligently, under the full realization of its meaning, viz., that it denotes simply a tendency to an inflammatory condition of low type, which condition tends rarely to resolution or absorption, sometimes to caseation, more frequently to destructive and degenerative processes, it may still be useful, since we cannot discard the old term altogether, and in the minds of many surgeons it has for years indicated just this tendency. It is far better, however, to keep clearly before the mind the fact that tubercle is both pathologically and clinically the recognized condition.

As we advance still further in knowledge, our ideas will doubtless change as new discoveries add new light. We know that local tuberculosis is a constant menace to the constitution; that its early removal is of advantage, if complete; and it is doubtless owing to this fact that early incision has gained such popularity in England with Croft and others. Few will deny that the results from early excision are followed by good statistics as regards life and time saving; but, when we consider the question of the usefulness of the limb, as compared with the case properly cared for without operation, very serious doubts arise in the minds of the majority of surgeons.

The most troublesome element which we encounter in the removal of local tuberculosis is the fact that our powers of diagnosis are as yet insufficient. It is difficult for us to determine accurately as to the number of foci that exist, and their absolute situation. This is uncertain even after an incision is made; hence, we must advance our diagnostic powers *pari passu* with our surgical skill. Again, we are obliged to proceed cautiously with operative measures lest our efforts at removal be the direct cause of rapid infection of the general system.

The more one studies the tuberculous process in various parts of the body the more convinced he must be as to the unity of the condition. Variations will occur in joints as well as in lungs, but the process is the same. The aggregation of lymphoid or of giant cells into miliary bodies progressing to caseation, or degenerating into pus, are but steps in one and the same general process. We cannot properly compare these in different portions of the body unless

we watch them at similar stages. The presence of the bacillus tuberculosis has been proven as positively in joint tuberculosis as in lung tuberculosis.

The explanation of the cause of special local infection, whether in bones, glands, joints or lungs, is a question open for further pathological research. At present we can only say that while all portions of the body are liable to be invaded by the bacillus, yet that certain parts possess greater resistive capacity and hence escape. In the neighborhood of the joints in young children (in which class local tuberculosis is most common) are situated the epiphyseal centres, which are the points of great functional activity. These centres are freely supplied with embryonal cells, which cells are in all parts of the body feeble in resistive power. The cancellous tissue in the neighborhood forms a favorable soil for invasion. The tissue of the cartilages is less prone to yield, yet cartilages loosened from their attachments and deprived of subjacent nutrition will speedily necrose. The synovial membrane is frequently a point of infection in young children, particularly its fringes. Being less rudimentary or developmental in character, the cells fall an easy prey to the ravages of the bacilli as they are also centres of great nutritive growing processes. That this theory is correct is additionally proven by the fact that the tuberculous process in bone diminishes very rapidly in proportion as bone activity ceases during adult life. Tissue cells, like individuals, are best capable of warding off the attacks of the enemies when in their full strength and vigor, although debility of local cell power is not absolutely dependent upon constitutional power and vigor. In embryonal tissues where the growth is active the rapid blood current brings to the region a larger number of infecting bacilli, and their power for harm is largely increased whenever the resistive power of the cells is impaired by the congestion and debility following even slight traumatism with its consequent inflammatory processes.

The question of the effect of heredity upon the tubercular process is at present attracting much attention. I am satisfied, from practical observation, that it has much to do with the determination of this process, even although we may not be able pathologically to determine the precise steps. The fact exists that the children of tuberculous parents are less liable to resist the onsets of the bacilli than are the children of robust parentage.

Cell resistance may be largely altered by other causes, and many children of non-tuberculous parentage may, by bad hygiene and by traumatism, or by other causes of local congestion or inflammation with its consequent greater saturation with infection-carrying blood cells, become subjects of local tuberculosis. Whether the infection reaches the bone cells through the medium of the circulation, or by inoculation, the results are similar. A robust child of robust parentage, even though frequently subjected to traumatism, has usually cell-resistive power; but inflammatory processes and the exudation of young cells result as a consequence of the injury, and infection may then readily occur. This fact will explain the occurrence of local tuberculosis in strong, healthy children. Viewed in this light, it is not strange that traumatism has been urged as an actual cause of joint disease. I think there are few, however, who would subscribe to the dictum of a surgeon whom I heard assert in the Con-

gress of 1886 that "hip disease was *never* connected with a strumous diathesis except by the accident of coexistence."

The improvement of the general health is as rapid after erasion as it is after excision, largely from the avoidance of the great drain upon the constitution. The operation has been condemned by some surgeons as unsuitable for children, but it has been my experience that it is particularly appropriate for persons in early life, and that it sometimes results in complete motion. It is even possible that young patients may recover with limbs almost equal in length, but such results are, of course, unusual.

I have not had an opportunity of practising erasion upon the shoulder- or wrist-joint, but in the elbow, the ankle, and the knee particularly, as well as the tarsal region, and sometimes at the hip-joint, it has given fairly satisfactory results.

Permanent cure may be expected if the operation has been thorough and complete. Apparent cure is rapid in the majority of cases, but it is sometimes deceptive. Quick union, which is the rule with antisepsis, often inspires too much hope. If tubercular foci have escaped removal, a few months will prove the incorrectness of this anticipation, as re-opening of the wound often occurs, and the progress of the disease is steadily onward.

The same objection, however, holds good in regard to excision, where, after complete closure for several months, the wound frequently re-opens from the fact that the disease has never ceased, even though, as in primary development, pus has been long in reaching the surface a second time. Even amputation does not insure against a return.

An objection to the operations both of excision and erasion is the fact that in the natural course of the disease without operation, over 90 per cent. of even suppurative cases escape tubercular infection, and although tuberculous material in the bone is a menace, yet it is claimed by some that the small percentage scarcely justifies either erasion or excision, as about an equal number of cases will occur either with or without operation. Unfortunately, we cannot be absolutely certain that all the diseased foci are removed, and, even if all local disease is removed, there is still no certainty but that deposits of a similar nature are present in other parts of the body. I have seen tubercular deposits in vertebræ, hip and ankle, and again in the shoulders, elbow, hip and knee of the same individual. Tubercular meningitis is, of course, the most frequent cause of death. This virulence of tuberculosis in multiple cases certainly warrants the belief that it should be considered almost as malignant as sarcoma, although its course and its nature are entirely different. Cancer cells are progressive and irresistible; tubercle can often be overpowered, limited and cast off by a good resistive constitution.

One of the points of diagnosis in existing caseation is the doughiness of the tissues surrounding the focus, and, if we wish to operate early, this must be sought for as a guiding signal. The advantage of early operation lies in the fact that we can then keep well outside of the tuberculous disease, and thus prevent the infection which sometimes occurs from the passage of the knife out of diseased into healthy tissues, just as in epithelial growths.

It is this eradication of tissue, *en masse*, which is contemplated by thorough erasion. After suppuration has occurred, eradication becomes more difficult. There are those who contend that in the latter stages of suppuration, particularly of hip disease, operation of any kind, other than simple drainage, or the removal of a loose sequestrum, is unwarrantable and prejudicial, unless, perhaps, the limb be removed by amputation.

We can, of course, lessen the dangers of inoculation by care in operating and by thorough antisepsis, as well as asepsis, and thus greatly diminish the death rate from acute infection, or from subsequent chronic tuberculous changes. In old suppurative cases we may often save life by removal of disease which is situated at the knee, arm, elbow or wrist, by amputation. But, as in a case now under my care, where I removed the limb at the thigh, we have no recourse against the return of the disease in another joint, and in that case the tubercle is now invading the elbow.

We find from experience that this recurrence often takes place after amputation, as well as after excision or erasion. We certainly are as yet unable to diagnose with more positiveness the existence or non-existence of tubercular infection than we can determine similar stages of syphilitic,sarcomatous, or carcinomatous infection.

When once a joint has been opened, all caseating foci should be removed. If we could be positively certain, without incision, that caseation was taking place, it would, perhaps, in many cases, be wise to avoid operation, especially in hip disease. As our diagnosis, according to our present knowledge, is still subject to uncertainty as regards the question of suppuration, we frequently find caseating foci in addition to others which have undergone degenerative suppuration.

The presence of dead bone is usually indicated by abscess, pain and contraction of the muscles, although the two latter symptoms, especially contraction, are present from the inception of the disease. The simple incision of an abscess without removal of the dead bone, even although thorough drainage is instituted, rarely hastens the process of bone separation. Its chief benefit is in removing from the body irritating material, which is liable to burrow through the diseased tissues and give daily high temperatures. The objection to incision and drainage without removal of the diseased foci is the fact that unless persistently and antiseptically dressed this open sinus becomes an avenue for the admission of germs.

At the knee-joint, where the operation of erasion is followed by the best results, foci of considerable size may be removed from the condyles or from the head of the tibia, and, if the epiphyseal line is not reached, there will be but little interference with growth. The operation is especially indicated in young children, where, after tenotomy of the ham-strings, and partial rectification of the deformity with fixation of the joint, the degenerative process still continues. By one, or both, of these plans (that is, tenotomy and erasion) these cases in young children can be advanced in growth, even although time is lost, and far better results can be obtained, than can be secured by early excision. Excision removes so many epiphyseal cells that it becomes a crippling operation when performed upon the knee in very young children.

In former times amputation was the chief resort in desperate cases. This has, for years, been largely replaced by excision, and the time has now come when we can make still farther advance and apply erasion to some of these cases with excellent results. It is not to be expected that all these cases of erasion will heal; very frequently undiscovered foci will remain and the disease will progress; but the same is true of excision, and offers no argument against the operation. In some cases subsequent excision, and even amputation, may become necessary, and if high temperature continues after operation, it is probable that the disease is progressing, and that a second operation, or an excision, may be required. A couple of months after operation is sufficient to determine the question whether ankylosis will or will not take place.

What has been said in regard to the knee is true also in reference to the elbow, where many cases can be treated satisfactorily by the lesser operation.

It has been objected that this operation at the elbow is more liable to give ankylosis than when excision has been performed. The joint following a small excision at this region of the body is sometimes a very useful one, but, in any instance where the removal of the bone has been so great as to give a weak joint, a firm ankylosis in good position is preferable.

The amount of shock that follows erasion is much less than that of excision, the time required is shorter, hemorrhage is not so severe, and the after treatment by fixation is ordinarily less prolonged. The primary object of the operation is, of course, to secure ankylosis, unless it be at the hip-joint, and even there this result is one ordinarily obtained.

It will not do to compare results following this operation with those obtained in cases of joint disease treated in various ways. Comparison should be made with excision and an equal number of similar cases which have advanced sufficiently to demand operative measures. Just where this line lies is as yet disputed ground, but certainly those cases which have never shown any tendency to suppurate, and which have advanced to cure, should not be computed in any comparative table. The operation is too recent to make statistics of value, and all the cases performed within the last two years are still in a state of uncertainty.

The results following erasion are, like those obtained from excision, sometimes unsatisfactory. Those who follow up their cases, whether in Germany, England or America, find that secondary operations become necessary in many cases, and even large operators like Wright and others confess that from 80 to 90 per cent. are unsatisfactory.

Volkmann for years practised under the name of erasion this gouging and digging away of diseased tissues, and although not perfectly performed by him until later years, yet his results were also unsatisfactory. Erasion must, of course, take a secondary place in all instances of extreme destruction. The operation is still *sub judice*.

McArdle[1] reports 41 cases of permanent recoveries, but it would be interesting to have reports of these two years hence.

Marsh[2] states that of 401 cases of hip disease treated without operation, 31

[1] Lancet, November 30, 1889.
[2] Transactions Clinical Society, London, 1888, '89.

died from suppuration ; 69 per cent. of non-suppurative cases were cured, and 10 per cent. died ; of non-suppurative cases, 89 per cent. recovered with the use of the limb ; 10 per cent. died. Of those deaths, 9 per cent. were from tuberculous troubles ; 69 per cent. of cases suppurated, of whom 33 per cent. died without operation. Many died from albuminoid degeneration and exhaustion. Many of these cases could doubtless have been saved by early operation.

In 839 cases of excision, reported by Wartmann, 10 per cent. of deaths following operation were from miliary tuberculosis.

In 144 excisions Sack gives five deaths from tuberculosis.

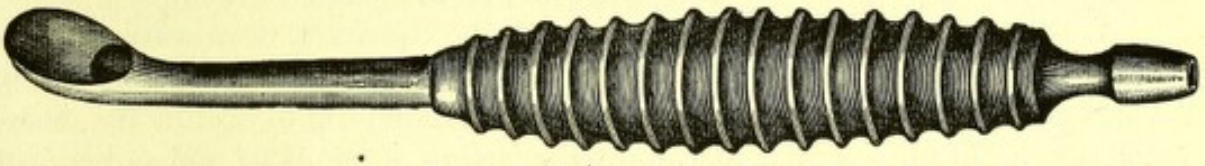
In 45 excisions Croft gives eighteen deaths from tuberculosis.

In 120 excisions there were 36 per cent. of deaths, one-half from tuberculosis, according to Grosch.

In 95 cases of tuberculous knee reported by Willimer (all under Koenig's care), ten to thirteen died from the direct effect of the excision.

The principal instruments required in erasion are the knife, scissors, curette and gouge. Scissors curved upon the flat are exceedingly useful in reaching the bottom of the various pockets. Any tissue that can be removed with safety should not be allowed to remain.

A sharp spoon, or gouge or chisel, will perform all this work, but I prefer this curette (illustrated in the figure) which is a sharp spoon with a hollow handle,



Hollow Irrigation Bone Curette.

made strong and of good size, to permit the passage through it of a large stream of water. The diameter of the bore should be at least three-sixteenths of an inch, as it is important that the flushing process be rapid. The handle which I like best is three-fourths of an inch in diameter, slightly corrugated so as to give it a firm hold in the hand, and the entire instrument should not be more than 7 inches long. The edge should be very sharp, so as to cut the bone without bruising or tearing, as in any case the underlying layer of bone cells next to the portions removed are injured, and superficial caries at least must result. A sharp instrument will reduce the cell injury to a minimum. Over the nipple at the upper end of the handle is slipped a rubber tube, which is connected with a jar, fountain syringe, or other receptacle, which latter is filled with a hot sublimate solution and raised to any desired height above the operating table. It is unnecessary to have any attachment or loop, as suggested by Barker, for shutting off the current, since the carpal portion of the hand of the operator can be used to control the stream. This instrument avoids the point of a syringe and the hands of an assistant in the wound. If made strong and firm, the curette answers most of the purposes of a gouge and chisel, and it is easily manipulated. The bowl of the spoon is best made a half inch in width and three-fourths inch in length, which size can be conveniently manipulated for any joint of the body.

My experience in excision or erasion at the ankle-joint is very limited, as I seldom find it necessary, under rest and fixation, to perform any operation other than for drainage, unless it be to remove small fragments of bone. Some excellent results have been reported from excision in this articulation, and there have been a few cases of erasion, but I do not feel at all convinced but that the large majority of these cases, if conservatively treated, would recover, if not equally as soon, yet with better walking powers.

At the ankle I have found great difficulty in reaching all parts of the joint, and the incisions required are very free ones. An incision anteriorly and posteriorly directly in the median line seems to offer the best exposure for all diseased tissues of the joint. The ankle-joint may also be reached by a curvilinear incision passing longitudinally just behind either malleolus. Care must be exercised to preserve the bloodvessels and nerves, and, if possible, the tendons. Unfortunately, disease in that situation is rarely limited to the ankle-joint, since the tarsal bones soon become involved. Ankylosis is so common that the loss of a particular tendon may not be of special injury. Plaster of Paris, or a bracketed splint are the most convenient forms of subsequent dressing.

Erasion has been received with most favor, and has its best results, in the disease of the knee. This joint, which is frequently affected, seems well suited for the operation, especially as the foci of involvement are found very frequently close beneath the articular extremity of the femur or tibia.

At the knee a semicircular incision, with the convexity downward, passing through the tendo-patellæ, has proved most serviceable in my hands. All of us, however, are liable to become wedded to a certain form of operation. Some prefer a straight mid-patellar incision, with sawing of the bone and subsequent wiring of the fragments.

We anticipate and desire ankylosis after erasion, but occasionally in young children motion is secured. If evidences of involvement are slight, simple lateral incisions should be made for exploration purposes. When all existing foci of the disease can thus be reached, a larger opening of the joint is unnecessary, and the diseased tissues having been cut away recovery with motion may be expected. Should deeper portions of the joint processes be involved, the curved **U**-shaped incision may be employed and the joint more thoroughly exposed. I have never had trouble from non-union of the tendo-patellæ; nor have I ever chiselled off the tubercle of the tibia to preserve an attachment of this tendon, as suturing of the tendon with catgut seems to me less liable to produce suppuration than wiring of this fragment in its place. The wiring of the patella after a transverse cut also introduces an element of subsequent risk.

If the lateral crucial ligaments are not involved, the points underneath the ligamentum patellæ as far as the bursa beneath the crureus should be thoroughly excised. The mid-patellar incision does not seem to give as good access to the joint as the crucial cut, and the same is true of the **H** incision.

All the synovial depressions should be thoroughly searched and fungous diseased tissue, and any suspicious parts of the bone near the epiphyseal line should be gouged and extirpated. A pair of blunt scissors, curved upon the flat, are very useful in reaching the diseased tissues lying near the popliteal

space. The Esmarch bandage should be avoided during the operation, as it assists in pushing diseased cells among the healthy ones, and the application of the rubber tourniquet also favors subsequent oozing.

I have found pressure of fleecy antiseptic wool applied outside of the sublimate gauze to be an exceedingly favorable subsequent dressing. Oozing may also be prevented by high elevation of the limb. If there is much soiling of the dressing, and as soon as signs of decomposition are evidenced, it should be removed and a thoroughly antiseptic one re-applied after careful cleansing. Fixation of the joint may be accomplished by plaster of Paris, or by wooden or bracketed splints. I have found that it is well to employ artificial supports either of stiff leather or of steel for at least two years after the operation; some operators say four years.

The question of drainage after operation is, of course, an important one. Rubber drainage is exceedingly useful not only in correcting any errors in antisepsis in the work of the operator, but also to act as a primary drain for collected fluids. These drains, however, should be removed early; sometimes at the first dressing; certainly at the end of the first week. Their too long continuance tends to induce suppuration. Having relieved the joint of bloody and serous accumulations in the first few days their work is accomplished, and, as a perfectly clean operation should not be followed by suppuration, the danger of burrowing pus is small. Where the loss of substance is considerable, and the bone suppuration marked, the drainage is best made through the popliteal space.

About the hip-joint it is exceedingly difficult, by any form of incision, to thoroughly reach all portions of the synovial membrane, cartilages and bone, especially when the ilium is involved. The ordinary **S**-shaped incision passing over and behind the trochanter, or the incision of Wright, or Langenbeck, from the posterior superior spine over the trochanter as far as needed, yields a fair exposure of the joint. I have never employed anterior excision, but its advocates speak highly of its advantages. The operator can work boldly, as there are few large vessels to be avoided. The capsule is soon reached, and the articulation can be explored with the finger, which is far more satisfactory than the probe. Unless an absolutely clean extirpation is accomplished, this incision does not seem to offer any advantages, and it does not secure good drainage, which even Barker's cases show is necessary.

The sharp hollow spoon already described answers an excellent purpose for this work, as it permits the immediate flushing out of tuberculous matter as fast as it is loosened, with simultaneous disinfection of the wound. The sharp gouge is also a valuable instrument for cleansing the acetabulum. The sinus walls are often troublesome to remove, but with sharply curved scissors, and with a knife it can be accomplished. In old suppurative cases where excision is deemed unwise, erasion will often greatly lessen the pus discharge and hasten cure.

It is better to drain with rubber tubes than with catgut unless an absolutely clean wound has been secured, but these tubes should be withdrawn early. The wound may be allowed to fill with fresh blood clot for organization, or it can

be deeply sutured with catgut and closed dry. Iodoform is a good dressing in all tuberculous diseases, but antisepsis should be secured by corrosive sublimate or other effective measures.

The subsequent treatment should consist in extension by weight and pulley, with sand bags from axillæ to feet, and infrequent dressing followed by long and continued application of a splint that will protect and fix the hip.

For erasion of the articulations of the upper extremities the lines of incision will either follow old sinuses, or will be made as for excision. The steps of the operation are the same as those employed in the lower limb, and the subsequent dressing should be fixation by gypsum or wooden splints.

CONCLUSIONS.

I. Erasion is a conservative operation designed for the removal of tuberculous material of both soft and hard parts in the region of the articulations, with the least possible sacrifice of healthy tissue. In caseating cases, which have not advanced to suppuration, if all the foci can be reached and removed, most happy results will follow. In pulpy degenerations, especially at the knee, an excellent cure will usually result.

II. Erasion is not intended to supersede excision, but only to act as a substitute for it in certain cases of tuberculous bone and joint degeneration at an early stage, or in cases where destruction of the bone is limited. In children it is especially valuable, since it interferes less with the epiphyseal cells, and with the subsequent growth. It has proved of special value at the knee-joint in children where by tenotomy and erasion repeated from time to time, excision can be delayed for several years, and the growth of the limb thereby secured. The element of time with many children is not of serious importance.

III. As excision has diminished the number of former amputations, so erasion will diminish the number of future excisions.

IV. Knife, scissors, scoop and gouge are all needed in the operation.

V. Subsequent ankylosis is usually to be expected.

VI. The operation is more quickly performed than excision, produces less shock, and if extirpation is complete much time is gained.

VII. Thorough and complete asepsis, good drainage, thorough subsequent fixation and absolute protection of the joint for a long period of time are all essential factors in securing good results.