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OSTEOARTHRITIS AT THE BASE OF THE THUMB

The Concept of Monoarticular Reconstruction

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Osteoarthritic affection of the base of the thumb involving 148 hands has been studied. Isolated osteoarthritis of the trapezio-metacarpal joint was found to be the largest group including a total of 111 hands. Reconstruction of this particular joint by a new technique is described and long-term results reported. A small series of isolated osteoarthritis of the trapezio-scaphoid joint is presented and reconstruction by replacing the affected articular surface of the carpal scaphoid is described. Osteoarthritic involvement of more than one of the articular surfaces of the trapezium was found in a group of 31 hands. In all of them the trapezio-metacarpal joint was predominantly affected. The rationale for monoarticular reconstruction of the trapezio-metacarpal joint, regardless of the extent of involvement, is discussed in detail.

Key words: osteoarthritis; trapezio-metacarpal joint; trapezio-scaphoid joint; silicone arthroplasty

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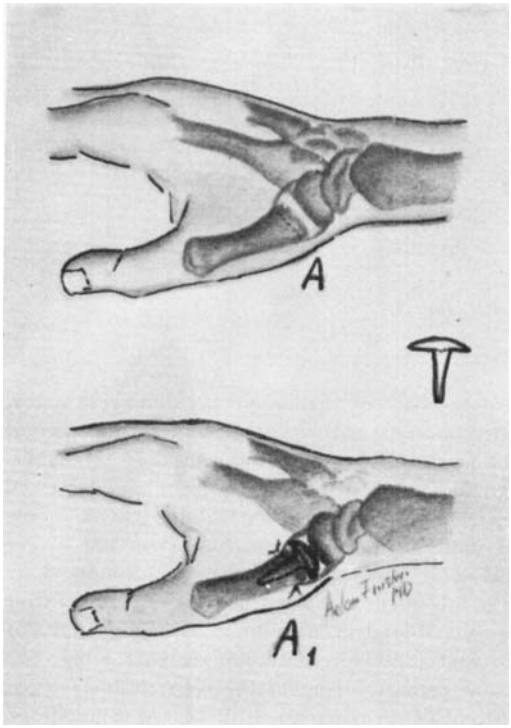
Two contradictory concepts regarding the pathogenesis of so-called osteoarthritis at the base of the thumb have been described during the last decade. According to the first concept, in most cases, degenerative changes develop at the trapezio-metacarpal joint, without involving the other articular facets of the trapezium. The second concept postulates that osteoarthritis always develops at all or most of the articulating surfaces of the trapezium.

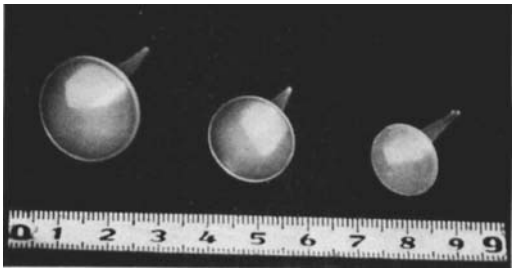
An interesting view has been expressed by Burton (1973), who claims that osteoarthritis at the base of the thumb develops progressively through three stages. The first two stages involve the trapezio-metacarpal joint alone, whereas the third, most advanced stage, represents a pantrapezial osteoarthritis. According to his concept, a panarthrosis is the final outcome of the process at the base of the thumb.

Surgery, in cases which do not respond to conservative treatment, has been greatly influenced by the concept of pathogenesis adopted by the surgeon. Arthrodesis of the trapezio-metacarpal joint, which is probably the most commonly used surgical procedure for osteoarthritis, is based on the concept of isolated osteoarthritis of the trapezio-metacarpal joint (Müller 1949, Leach & Bolton 1968, Eaton & Littler 1969, Carroll & Hill 1973). Nevertheless, excision of the trapezium has been practised by those who believe that the trapezium is the centre of a generalised osteoarthritic process (Gervis 1949, Murley 1960, Sims & Bentley 1970).



A

Figure 1. The drawing shows the level of resection of the metacarpal base (dotted line) and the implant introduced into the trapezio-metacarpal joint. Figure 1 B shows the implant as currently produced in three sizes. Figure 1 C represents the radiological appearance of the trapezio-metacarpal arthroplasty, with the first metacarpal in abduction and adduction.



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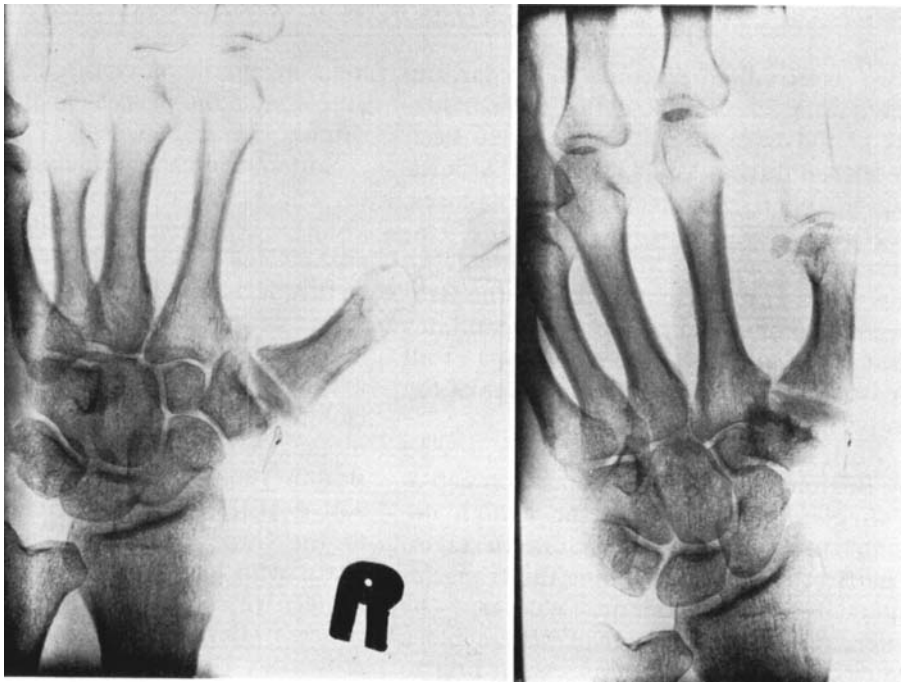


B

In recent years arthroplastic procedures of the trapezio-metacarpal joint have been suggested instead of arthrodesis (Froimson 1970, Wilson 1971, personal communication) and replacement of the trapezium with a silicone implant has been advocated instead of a plain trapezial excision (Swanson 1972). Another method for arthroplasty of the trapezio-metacarpal joint has been developed and practised since 1966. This consists of a limited resection of the base of the first metacarpal and introduction of a moulded silicone implant into the gap (Figure 1).

The purpose of this paper is to report the long-term results with this type of arthroplasty and to discuss the authors' philosophy towards the pathology at the base of the thumb.

MATERIAL AND METHODS

One hundred and forty eight hands (100 patients) showing clinical and radiological signs of osteoarthritis at the base of the thumb have been examined by the authors since 1966. Seventy-six hands underwent surgery; the rest were adequately relieved by conservative treatment. All 148 hands were re-evaluated during 1975. The roentgenograms of all cases were re-examined, but clinical check-up could only be performed on 102 hands (72 patients). The age of the patients of the present series varied between 28 and 70 years. Seventy-two were female and 28 were male. In 48 patients the affection was bilateral (96 hands) and in 52 it was unilateral. In 40 patients with unilateral affection, the dominant hand was involved.

Re-examination of the whole series was aimed at determination of the precise location of the process. Most of the roentgenograms were taken at the same institute and consisted of two standard views of the base of the thumb: antero-posterior and lateral. In some of the roentgenograms there was no clear exposure of the joint space between the trapezium and the trapezoid; however, the trapezio-scaphoid joint was well exposed in all instances.

RESULTS

Results of the survey could be summarised as follows:

1. One hundred and eleven hands showed a definite isolated osteoarthritis of the trapezio-metacarpal joint. As mentioned before, we tried to be very precise and demanding in our evaluation. Even slight and obviously insignificant variations outside the trapezio-metacarpal joint proper were considered sufficient to exclude the case from the isolated group.
2. There were six instances of isolated osteoarthritis of the trapezio-scaphoid joint.
3. Thirty-one hands showed osteoarthritic changes at multiple articular surfaces of the trapezium. While in all cases the trapezio-metacarpal joint was predominantly affected, the most common additional involvement was in the trapezio-scaphoid joint.

Isolated osteoarthritis of the trapezio-metacarpal joint

In two previous communications (Kessler & Axer 1971, Kessler 1973) a series of 60 patients affected by osteoarthritis of the trapezio-metacarpal joint has been reported. Both papers dealt mainly with technical details and described results after an arthroplastic procedure intended to reconstruct only the trapezio-metacarpal joint, without interfering with the surrounding joints. The present series of 111 hands includes the series published before, but extends the follow-up to almost 10 years. Although surgery will be discussed in some detail, the emphasis of this report is placed on the correlation between the distribution of the osteoarthritic changes and the method of treatment.

Four patients underwent arthrodesis of the trapezio-metacarpal joint. Technically arthrodesis was achieved by resection of the articular surfaces of the metacarpal base and the trapezium, apposition and fixation with K-wires (Figure 2). A firm, bony union was achieved in three instances after 10, 11

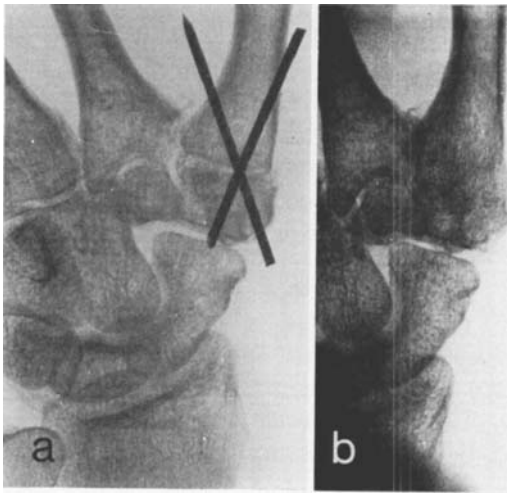


Figure 2. Arthrodesis of the trapezio-metacarpal joint. Fixation is achieved by two K-wires (A). The final result is a solid bony union (B).

and 16 weeks, respectively, and one case resulted in non-union. It is to be noted that follow-up in all cases was more than 8 years and in no case did the re-examination reveal any changes in the surrounding joints. All four were engaged in manual occupations and were satisfied with the result (including the case with non-union). Objectively, one case demonstrated 15–20° of limitation of abduction in comparison with the other hand; the rest had unobstructed range of motion at the base of the thumb.

Sixty-one hands of this series underwent silicone arthroplasty of the trapezio-metacarpal joint (Figure 1). The technique of this procedure has been described elsewhere (Kessler 1973). One point which is extensively discussed by most authors, but has not been properly covered in our previous communications, is the radial instability, or subluxation, which takes place in some of the cases with osteoarthritis of the trapezio-metacarpal joint (Figure 3). It seems that the extent of osteoarthritic changes is not the only, or even the main factor, for development of radial subluxation. There were many advanced cases in our series, without radial instability and in some other instances, subluxation was shown in the early stages of osteoarthritis. Habitual laxity of the trapezio-metacarpal joint is a well known phenomenon and radial instability can be demonstrated in people with gracile and hyperflexible joints. Whether radial instability is more pronounced in patients with habitual laxity of the trapezio-metacarpal joint, or whether it develops as a result of direct involvement of the ulnar supporting apparatus in a previously stable joint, remains to be proven. An interesting discovery in this respect has been made during the survey of the present series. Most cases that did not show a radial instability before surgery achieved stable arthroplastic joints, without reconstruction of the ulnar supporting apparatus. This fact could probably be explained by the technique that we employed. A very economical resection of the base of the

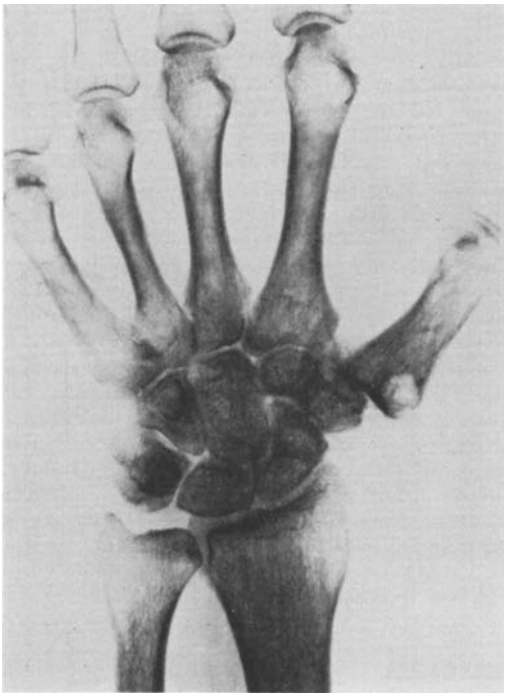


Figure 3. Radial subluxation in advanced osteoarthritis of the trapezio-metacarpal joint.

first metacarpal in most cases would not disturb the site of attachment of the ulnar ligament. In this way the normal relation between the articulating surfaces of the trapezium and the metacarpal base bearing the silicone implant would be preserved. On the other hand, some cases with preoperative instability resulted in persistent radial subluxation in spite of the uniformly improved subjective and functional condition.

Radial instability has been a constant problem in the replacement arthroplasty of the trapezium, in which division of the entire supporting apparatus is a technical necessity (Burton 1973). Experience has shown that reconstruction of the ulnar ligamentous support is the only way to keep the articulating surfaces of the implant and the carpal scaphoid properly approximated. A slip of flexor carpi radialis, as described by Eiken (1971), could probably also be used in arthroplastic procedures of our type, in cases which show preoperative radial instability of the trapezio-metacarpal joint.

Results after surgery in this series could be summarised as follows: Thirty-eight hands were recorded preoperatively as stable. Thirty-six of them resulted in stable arthroplastic joints without reconstruction of the ulnar supporting apparatus. In two instances the roentgenograms revealed radial subluxation. Twenty-two hands showed radial instability preoperatively. Fifteen resulted in radial subluxation. In seven hands the instability disappeared after surgery in spite of the fact that no reconstruction of the ulnar supporting apparatus was performed. This phenomenon could probably be explained by excessive fibrotic encapsulation taking place during the period of immobilisation, or tightening of the ulnar supporting apparatus due to the space-occupying effect of the implant.

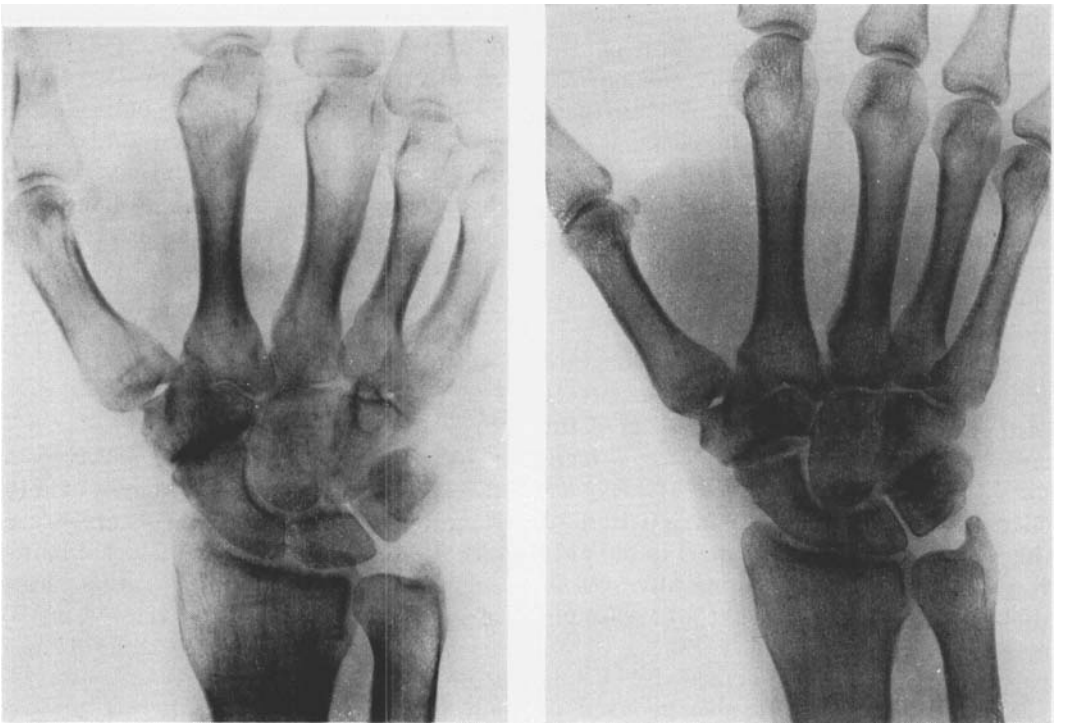
In one case in the early series there was a complete dislocation of the metacarpal base (Kessler 1973).

All cases but one reported significant improvement after surgery. Thirty-five were reported to be symptom-free but in 25 hands there was some pain or discomfort after exertion. It should be noted that there was no correlation between the postoperative positioning of the joint and the patients' evaluation of results. In many cases the radial instability was not regarded as disturbing by the patients.

Isolated osteoarthritis of the trapezio-scaphoid joint

As mentioned before, osteoarthritic involvement of the trapezio-scaphoid joint is quite uncommon. In the literature at our disposal we were able to find only one report describing a rather large series of 12 cases with isolated osteoarthritis of the trapezio-scaphoid joint (Carstam et al. 1968). Among the 148 hands of our series, only six showed definite radiological signs of isolated osteoarthritis of the trapezio-scaphoid joint (Figure 4). In one patient this condition was bilateral. Four patients demonstrated unilateral affections in their dominant hands. Four cases did not respond to conservative treatment and were submitted to surgery. Here again we were faced with a simple alternative: to fuse this joint or to reconstruct it. Motion at the trapezio-scaphoid joint is negligible and therefore a complicated method for reconstruction could hardly be justified. In these cases, the type of surgery should be determined by the simplicity of approach, as well as by the personal preference and experience of the surgeon.

In the first two instances a simple interposition of a thin silastic sheet (501–7, 0.040″) was performed, after resecting the articular surface of the trapezium. The corresponding articular surface of the carpal scaphoid was left undisturbed. A short cast was applied for 2 weeks and gradually increasing activity



A B

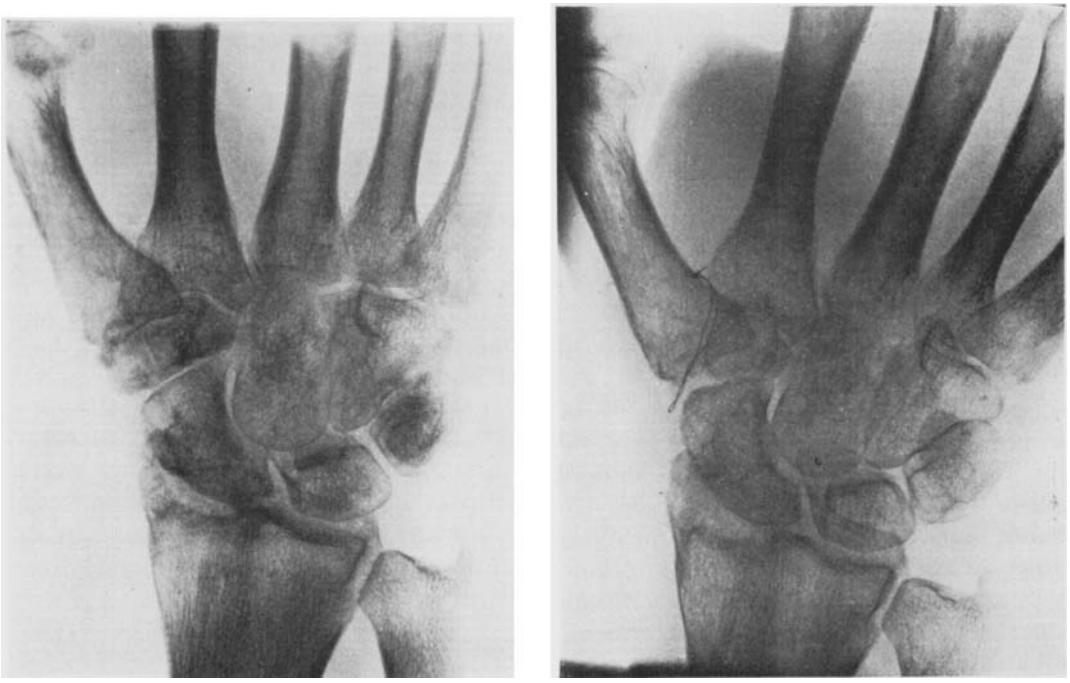
Figure 4. (A) Advanced isolated osteoarthritis of the trapezio-scaphoid joint. (B) shows an arthroplastic procedure achieved by resection of the distal articular portion of the carpal scaphoid and its replacement by a silicone implant.

was encouraged thereafter. No physiotherapy was necessary. In less than 1 month both patients returned to their former occupations. They were followed up for 6 and 7 years, respectively, and were both free of symptoms in the operated region.

More recently, acting on a suggestion by Dr. Eiken from Malmö (Sweden), the arthroplastic procedure of the trapezio-scaphoid joint was modified in such a way that the articular surface of the carpal scaphoid was replaced with the same silicone implant and the corresponding facet of the trapezium was left undisturbed (Figure 4 B). Although follow-up has been very brief and only two cases were operated, we feel that this procedure is superior to the first described and should be the procedure of choice in cases with isolated osteoarthritis of the trapezio-scaphoid joint. The arthroplasty of the trapezio-scaphoid joint does not require any ligamentous reconstruction and a simple suture of the joint capsule seems adequate.

Polyarticular osteoarthritis of the trapezium

Osteoarthritic changes involving more than one articular facet of the trapezium were diagnosed in 31 hands. In all instances but one the trapezio-metacarpal joint was predominantly affected. Reduced motion at the base of the thumb, various degrees of adduction contracture and advanced radiological changes were characteristic symptoms. Surprisingly, in spite of the pronounced degenerative



A B

Figure 5. Pantrapezial osteoarthritis of post-traumatic origin (A). After resection of the trapezium (B). Note the wide gap between the base of the first metacarpal and the scaphoiod.

changes, subjective complaints were mild to moderate.

All patients were given the conventional conservative treatment, including salicilates, indomethacin, splinting, paraffin baths, ultrasonic diathermy; and 26 of them had a course of deep X-ray therapy. Seven hands did not respond to conservative treatment and were referred for surgery. One of them, with a very advanced polyarticular osteoarthritis of the trapezium, was of post-traumatic origin and involved the dominant hand of a young patient. Resection of the trapezium was carried out (Figure 5). The patient was free of symptoms when seen at about 2½ years after surgery. The range of motion at the base of the thumb was normal. Dynamometric measurement showed reduced strength of pinch by about 30 per cent in comparison with the other (non-dominant) hand. The remaining six hands underwent silicone arthroplasty of the trapezio-metacarpal joint alone. In two cases release of the adduction contracture was carried out in addition to the arthroplastic procedure. Considering the fact that motion of the other articulations of the trapezium is negligible and under normal circumstances the main mechanical stress is born by the trapezio-metacarpal joint, an adequate relief of symptoms was expected after the reconstruction of this particular joint. After a follow-up varying from 2 to 7 years, results could be summarised as follows: Four cases were symptom-free; two were improved but still complained of pain and discomfort after prolonged exertion. In three hands the arthroplastic joints were stable and the other three showed radial instability. Motion was unobstructed in all instances.

DISCUSSION

The great discrepancy between the numbers of the conservatively treated and the operated patients of the isolated series, as compared with the series of polyarticular involvement of the trapezium, is the main feature brought out by the present study. More than half of the patients of the isolated series did not respond to conservative treatment and were referred for surgery; in comparison, only seven out of 31 patients of the series with polyarticular affection of the trapezium did not respond to conservative treatment. The remaining 24 showed adequate improvement after the conventional conservative treatment previously described. The greater response to conservative treatment by patients with advanced changes could probably be explained by the fact that they were all in a rather chronic condition, having previously passed the acute stage.

It is interesting to note that in many instances clinical symptoms in the relatively early osteoarthritis with isolated and incipient radiological changes were much more acute and disturbing than the symptoms reported by patients with advanced mono- or polyarticular changes of the trapezium.

Whereas arthrodesis or arthroplasty of the trapezio-metacarpal joint represents the logical management in isolated affections of this particular joint, a different approach seems to be required in a pantrapezial osteoarthritis. Resection of the trapezium, with or without inserting an implant, should provide the proper solution, by disengaging the affected articulating facets of the surrounding bones from the corresponding facets of the trapezium. This assumption would have been a very sound and reliable principle, if all joints surrounding the trapezium were of equal functional value. It is well known, however, that motion at the base of the thumb is provided mostly by the trapezio-metacarpal joint, the other joints having a minimal functional capacity. This is probably the reason for that joint being more exposed to trauma and repeated mechanical stress than any other joint or group of joints at the base of the thumb. The favourable results achieved by arthroplasty of the trapezio-metacarpal joint alone, even in cases of polyarticular involvement of the trapezium, also indicate that most symptoms in cases of osteoarthritis at the base of the thumb are predominantly related to the trapezio-metacarpal joint. Whether or not arthroplasty would delay or interrupt the further progression of osteoarthritic changes around the trapezium could not be determined by the present study.

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