SILICONE ARTHROPLASTY OF THE TRAPEZIO-METACARPAL JOINT

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The term arthroplasty of the trapezio-metacarpal joint has been used in the past to describe a procedure characterised by simple excision of the trapezium (Gervis 1949). This procedure does not restore the trapezio-metacarpal joint, but rather creates a gap between the articular surfaces of the metacarpal and the scaphoid bones. Recently Swanson described a new technique, in which the trapezium was replaced by a silicone implant. Reports of the early results of his method and some technical considerations have already appeared in the literature (Swanson 1968, Swanson 1970, Eiken 1971, Weilby 1971). In 1966 another type of arthroplasty was developed, aimed towards a proper reconstruction of the trapezio-metacarpal joint, without interfering with the adjacent joints. With this technique the trapezium was left undisturbed and reconstruction was by a limited excision of the base of the first metacarpal with replacement by a moulded silicone implant* (Kessler and Axer 1971).

The purpose of the present paper is to describe this method of arthroplasty of the trapezio-metacarpal joint and to discuss results in a group of patients followed up for two to five years.

MATERIAL

In early cases a simple interposition of silicone sheet was used; later a moulded implant was developed and was made in three sizes (Fig. 1).

![Fig. 1](image_url)

The silicone implants as prepared in three different sizes. Note that the stems are placed eccentrically so as to fit into the entrance of the medullary canal of the first metacarpal bone.

Thirty-eight silicone arthroplasties have been done in a group of sixty patients suffering from painful osteoarthritis of the trapezio-metacarpal joint. The indication for operation was a prolonged history of painful limitation of thumb movement in an active person, in whom conventional conservative treatment had failed to improve the condition. With the exception of seven patients in whom a silicone sheet was interposed during the second half of 1966, all

* Produced by Dow Corning, Midland, Michigan, United States of America.
received the moulded silastic implants. There were four bilateral operations, so that there were twenty-seven patients with moulded implants. The present study includes only those who have completed a period of at least two years since operation. From 1967 up to the end of 1969 we performed eighteen silicone arthroplasties of the trapezio-metacarpal joint, the final results of which represent the scope of the present study. One of the patients in this group underwent bilateral arthroplasty. There were fourteen women and three men. Their ages ranged from forty-four to sixty years. In fourteen instances operation was performed on the right hand and in four on the left. All patients but one were right handed.

**TECHNIQUE**

The trapezio-metacarpal joint is approached through a slightly curved incision centred over its radial-volar aspect. One of the cutaneous branches of the radial nerve runs almost
in the line of incision and should be protected. The periosteum of the first metacarpal, close to the joint, is cut longitudinally and stripped together with part of the thenar muscles, and the joint capsule is opened in the same plane. The long abductor is isolated and divided at its insertion. The articular surface of the first metacarpal is then resected and the joint is carefully inspected (Fig. 2). Rice bodies, which are occasionally found attached loosely to the synovial membrane, are excised. The same applies to any large protruding osteophytes. The medullary canal of the first metacarpal is easily entered through the cut surface of its base. We use for that purpose a specially designed reamer (Figs. 3 and 4). The base of the metacarpal is now ready to receive the implant. There is usually no difficulty in the insertion of the stem of the implant into the medullary canal, and the flat surface of the implant fits snugly the cut surface of the metacarpal base (Figs. 5 and 6). The thumb is brought into abduction and the capsule is sutured (Fig. 7). The tendon of the long abductor is advanced about two centimetres and is attached to and under the periosteum of the metacarpal shaft. The metacarpo-phalangeal joint is temporarily transfixed with a thin Kirschner wire (Fig. 8). The wound is closed and a short plaster splint is applied for three weeks.
Advancement and reinsertion of the long abductor and transfixion of the metacarpophalangeal joint were added to the basic technique at the end of 1969. In the earlier cases we did simple closure of the capsule and periosteum as previously reported.

**DISCUSSION AND RESULTS**

The trapezio-metacarpal joint is described in the literature as a universal joint which moves in almost all directions. Motion is permitted by the unique shape of its articular facets, of which the proximal one is concave and the distal convex (Smith and Holcomb 1959). This principle somewhat simplified was adopted in the design of our silicone implant. A single faced curved lens was found to be the best suited to the corresponding concave surface of the trapezium.

The trapezio-metacarpal joint is a common site of osteoarthritis. Occasionally it even represents the only location of the process in the hand. In contrast to the findings in other series, our material has not shown any relationship between the trapezio-metacarpal and the trapezio-scaphoid joints in the development of osteoarthritis. Osteoarthritis of the trapezio-metacarpal joint has not necessarily been accompanied by similar changes in the trapezio-scaphoid joint. In fact, we have seen only four instances in more than sixty patients in which osteoarthritis of the trapezio-metacarpal joint has been associated with radiological evidence of osteoarthritis of the trapezio-scaphoid joint. It is interesting that fusion, which is probably the best tried treatment for osteoarthritis of the trapezio-metacarpal joint, was primarily adopted because of the rarity of affection of the trapezio-scaphoid joint (Leach and Bolton 1968, Eaton and Littler 1969, Eiken and Carstam 1970).

Reconstruction of the trapezio-metacarpal joint is aimed not only at elimination of pain, but equally important, at obtaining stability and movement which are the basic requirements for normal thumb function. Obviously proper positioning and immobilisation of the thumb during the time of healing of the tissues surrounding the implant play an important role. In our early series we used a simple plaster splint which included the thumb up to the interphalangeal joint. However, the rigid pressure of the plaster on the proximal phalanx, and the pulling effect of the adductor on the first metacarpal bone, caused in many instances a painful hyperextension of the metacarpophalangeal joint. In five instances persistent symptoms of stenosing tendovaginitis of the long flexor of the thumb necessitated release of the tendon sheath. In two cases hyperextension mobility of the metacarpophalangeal joint was permanent and disturbing. In one case, which will be discussed in detail, dislocation of the trapezio-metacarpal joint occurred in spite of immobilisation. The radiographs revealed hyperextension of the metacarpophalangeal joint rather than true abduction of the thumb. In order to avoid these complications and to achieve better control over the position of the thumb, we introduced Kirschner wire fixation of the metacarpophalangeal joint in slight flexion. The Kirschner wire is removed at the end of the third week, when plaster immobilisation is discontinued. The second modification of our basic technique has been to advance the insertion of the long abductor of the thumb. We believe this step provides an additional support to the postero-radial aspect of the joint and stabilises the first metacarpal, thus improving abduction (Wilson 1971).

**Assessment of results**—Criteria for assessment of results were as follows.

*Blanching phenomenon*—The patient can touch the tip of the little finger with the tip of the thumb and transmit sufficient pressure to blanch the skin of the pressing surface (Eaton and Littler 1969). These conditions were met in all cases, including that of the patient with the dislocated joint. The blanching phenomenon is a test which can hardly provide useful information about the functional condition of the thumb. Even patients with badly destroyed and dislocated trapezio-metacarpal joints could demonstrate a perfectly normal blanching phenomenon. More precise information could be obtained by asking the patient firmly to
pinch a sheet of paper between the thumb and the little finger. A nearly normal pinch is demonstrated in cases in which the sheet could not be withdrawn. This condition was met in our series in all but four cases.

Ability to touch the base of the fifth finger—This test is more precise than the previous one and indicates the flexibility of the interphalangeal, metacarpo-phalangeal and trapezio-

metacarpal joints and to a lesser extent the trapezio-scaphoid joint. It is one of the best criteria for evaluating the function of the thumb, since it demonstrates in fact the range of palmar adduction. Adduction contracture of the first metacarpal, even of moderate degree, would prevent the tip of the thumb from touching the centre of the base of the fifth finger.
In our series seven thumbs could reach the centre of the base of the fifth finger; in another five cases the thumb could touch only the radial side of the fifth finger. In five more cases the thumb could touch the base of the second, the third and the fourth fingers, but it could not touch the fifth. In one case—that of the patient with the dislocated trapezio-metacarpal joint—the thumb could touch only the base of the second finger.

The metacarpal angle—The measurement of the angle between the first and the second metacarpals in adduction and in radial abduction provides a useful means for the evaluation of motion at the trapezio-metacarpal joint (Leach and Bolton 1968). This angle can be measured in radiographs taken in pronation, with the hand on a flat surface, as recommended by the Committee on Standardisation of Nomenclature, appointed by the International Federation of Societies for Surgery of the Hand (1970). Measurement of the metacarpal angle was routinely employed in our follow-up examinations. In five cases the range of movement was more than 40 degrees; in eight cases, in spite of proper placing of the implant and uncomplicated course after operation, movement was somewhat decreased and ranged between 30 and 40 degrees; in four cases the range of movement was between 20 and 30 degrees; and in one case it was less than 20 degrees (Figs. 9 to 11).

Pain—Eleven joints were completely freed from pain. Four other patients reported some pain only after prolonged exertion. In two instances, patients complained of pain over the middle of the carpus, quite away from the region operated upon. They were convinced that symptoms developed after operation and that they were not of the same characteristics as those present before operation. In one of these cases a painful neuroma of the cutaneous branch of the radial nerve seemed to be the cause of pain; in the other case the source of pain could not be determined.

In one case, that of a fifty-year-old woman, the trapezio-metacarpal joint dislocated during the first week after operation. An attempt at closed reduction failed. The patient declined further intervention. Follow-up examinations showed a completely dislocated joint, with adduction contracture of the first metacarpal (Fig. 12). Owing to hyperextension of the metacarpo-phalangeal joint of the thumb, she gradually regained some function and returned to her work as a librarian. Though appearance and function were considerably impaired, she kept insisting that pain was less than before and she refused further operation.

Personal evaluation—All but one patient reported great improvement after operation. All returned to their former occupations. An attempt has been made to obtain more details about their ability to perform fine work, as well as to use the thumb in the process of sewing or handling small objects. With the exception of a single patient who described some feeling of instability when pressing the thumb against hard and fixed surfaces, none could contribute any useful information. The patient with the dislocated joint was classed as a failure.

SUMMARY

1. A review of seventeen patients who underwent silicone arthroplasty of the trapezio-metacarpal joint by prosthetic replacement of the base of the first metacarpal is reported.
2. Eighteen operations were performed and observed for periods varying from two to five years.
3. The technique of operation and the criteria for the assessment of results are discussed.
REFERENCES


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