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Review article

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Arthroplasty of the metacarpophalangeal joint (literature review)

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Abstract

Introduction Diseases and injuries that affect the small joints of the hand, the metacarpophalangeal, in particular, lead to a limitated hand function and a reduced quality of life. The high functional demands of the hand impose strict restoration requirements and the development of the new and improvement of the existing surgical treatments of hand joints remains a serious challenge for the medical community. Arthroplasty of the metacarpophalangeal joint is widely used and can help restore function to hand. Despite the long history of arthroplasty procedures there is controversy concerning functional results. **Objective** Review foreign and Russian literature on metacarpophalangeal joint replacement and analyze the current state of the problem. **Material and methods** Foreign and Russian scientific publications on the treatment of metacarpophalangeal diseases and injuries were reviewed. Online searching for the articles published in Russian and English in the last five years was performed with the help of GoogleScholar, PubMed, eLIBRARY, PubMedCentral using the keywords "arthroplasty of the metacarpophalangeal joint", "osteoarthritis of the metacarpophalangeal joint", "finger joint replacement". **Results and discussion** Today, a wide range of total hip prosthesis designs, differing in geometric configurations and features is available with the current trend towards adaptation of the soft tissues to the structural modifications. Major indications for the use of different types of arthroplasty have been identified. Specific design features of implants can show higher failure rates and postoperative complications. **Conclusion** Arthroplasty is the best surgical treatment option for diseases and injuries of the metacarpophalangeal joint and improved construction solutions and materials for metacarpophalangeal arthroplasty are essential for better outcomes.

Keywords: metacarpophalangeal arthroplasty, metacarpophalangeal osteoarthritis, finger joint replacement

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INTRODUCTION

The human hand is a unique tool that executes the commands of the brain, expressing the subtleties of the mind. Performing the tasks, the hand is capable of reproducing an infinite number of positions, some of which are expressive, some are associated with certain touches, others are involved in the interaction with objects to obtain information, and some are aimed at applying various forces to the object. To perform a whole cascade of tasks, our hand must be an adaptable tool, a chameleon capable of an infinite number of positions [1, 2]. The grip function is one of the main abilities of the human hand. In 1956 Napier classified the grip into power and precision grip. With a power grip, the object is held by "forceps" formed between partially bent fingers 2–5, the base of the palm and the ray of the thumb opposed to it. With a precision grip, the object is clamped between the flexion surfaces of fingers 2–5 and the opposing thumb [3]. With this simple division and infinite set of positions, acts the perfect instrument provides interaction with the environment and our own body [4, 5, 6]. But the symphony cannot be harmonious if the strings of the solo instrument are damaged: restoring the function of its components to allow precise, accurate movements of the hand is the primary task of the hand surgeon and other specialists. Understanding the biomechanics of the hand joints, the interaction of the smallest structures and the precise restoration of their function is one of the keys to the comprehensive restoration of hand function [7]. Surgery for small joints of the hand and metacarpophalangeal, in particular, has been developed over several decades. Based on the experience of non-physiological methods of treatment first, and subsequently arthroplasty of larger joints, researchers and clinicians have achieved some success in arthroplasty of small joints of the hand [8]. Despite the long and thorny path of development and the variety of implant designs, metacarpophalangeal arthroplasty is characterized by conflicting results and a high rate and variety of complications [9]. The search for new construction solutions for implants and materials for the manufacture is required for effective restoration of hand function.

Objective Review foreign and Russian literature on metacarpophalangeal joint replacement and analyze the current state of the problem.

MATERIAL AND METHODS

Foreign and Russian scientific publications on the treatment of metacarpophalangeal diseases and injuries were reviewed. Online searching for the articles published in Russian and English in the last five years was performed with the help of GoogleScholar, PubMed, eLIBRARY, PubMedCentral using the keywords "arthroplasty of the metacarpophalangeal joint", "osteoarthritis of the metacarpophalangeal joint", "finger joint replacement". The review also includes current scientific publications on the functional anatomy and biomechanics of the metacarpophalangeal joint. Publications brought out between 1959 and 2022 inclusive were reveiwed.

RESULTS AND DISCUSSION

Understanding the anatomical and biomechanical features of the links of this uniquely precise and extremely complex organ is crucial for the success of arthroplasty of the small joints of the hand. Below are the current anatomical information about the metacarpophalangeal joint, which is important from a surgical and clinical point of view. The metacarpophalangeal joint (MPJ) is the articulation formed by the heads of the metacarpals and the bases of the proximal phalanges of the hand. The MPJ of the thumb is classified as a hinge joint to a flattened shape of the head of the first metacarpal that is responsible for the different kinematics and limited range of motion as compared to the rest of the fingers. MPJ of fingers 2–5 will be discussed. For the condylar shape, the MPJ has two degrees of freedom: flexion/extension, adduction/abduction, and circumduction [10, 11]. The articular surfaces of the joint have specific shape in the surgical, biomechanical and bioengineering aspects. The articular surface is narrow in the dorsal part of the metacarpal head and broadens into the volar aspect of the joint with the congruence of the joint increasing with the transition to the flexion position. The condyles of the head are also asymmetrical: the radius is larger than the ulna that is more pronounced in the joints of the 2nd and 3rd fingers. This is responsible for the ulnar deviation of the fingers in arthritis. The attachment points of the collateral ligaments are represented by dorsolateral tubercles of the heads, and the attachment sites of the tendons of the interosseous muscles are represented by grooves oriented from the proximal volar to the distal dorsal aspects [12]. The base of the proximal phalanx has a smaller radius of curvature of the articular surface than that of the metacarpal head. The metacarpal head has a larger sagittal and smaller transverse dimension, and the base of the proximal phalanx has a larger transverse dimension [13]. The articular capsule of the MPJ, attached along the neck of the metacarpal bone and the palmar and dorsal crests of the base of the proximal phalanx, is relatively free and loose, but is surrounded by important biomechanical structures at all sides. The articular capsule is reinforced by the extensor aponeurosis dorsally and by the volar plate on the palmar side, a thick fibrous layer woven into the deep transverse metacarpal ligament that connects and holds the heads of the 2nd to 5th metacarpals together. The volar plate is strong and elastic and is a powerful protector of dislocations in the MPJ. The most important function of the palmar plate is to ensure the congruence of the differently shaped articular surfaces of the MPJ.

The joint capsule is strengthened laterally by the sagittal bundles of the extensor aponeurosis, collateral ligaments and tendons of the interosseous and vermiform muscles. Collateral ligaments have an important role in the functioning and stabilization of the MPJ. They are located in two layers: the deep layer is represented by the collateral ligaments, and the superficial ligament is represented by additional collateral and phalango-glenoidal ligaments. The proper collateral ligament runs from the dorsolateral tubercle of the metacarpal head to the lateral tubercle of the base of the proximal phalanx. The accessory collateral ligament extends from the metacarpal head groove to the palmar plate [14]. Superficially located are the phalango-glenoidal ligaments, which run from the base of the proximal phalanx and are woven into the palmar plate and the annular ligament of the tendon sheath. They function synergistically with accessory collateral ligaments [15].

The condition of the ligamentous apparatus is of great clinical importance depending on the position of the joint: the own collateral ligaments, located dorsal to the center of rotation of the MPJ, are stretched at flexion and relaxed during extension, and additional collateral ligaments, located volar of the center of rotation, are relaxed at flexion being tight at extension. These biomechanical features should be considered with hand immobilization: flexion in the MPJ up to 80–90 degrees is considered to be the optimal position to prevent shortening of the own collateral ligaments and postimmobilization contractures [16, 17].

Therefore, the stability of the MPJ is ensured by the following factors:

1) the shape of the articular surfaces. The spherical type of articulation, the convex metacarpal head and the concave base of the phalanx prevent subluxation and complete dislocation in the joint at normal activities;

2) the articular capsule, collateral ligaments, palmar ligaments and volar plate create the capsular-ligamentous

apparatus of the joint. The capsular-ligamentous apparatus is the primary stabilizer of the MPJ;

3) the own muscles of the hand – interosseous and vermiform – together with the "external" muscular apparatus of the flexors and extensors acting through the tendons passing palmarly and dorsally, respectively, are the third link ensuring the stability of the MPJ and the kinematics in hand functioning.

These anatomical and biomechanical factors should be considered in the surgical treatment of diseases and injuries of the MPJ, in joint replacement, in particular. Current trends in joint surgery show the need for a thorough study and understanding of biomechanics to achieve optimal outcomes, and we provide up-to-date information on this issue.

The amplitude of flexion in the MPJ is 90 degrees and increases from the second finger to the fifth. Active extension in the MPJ is 20-30 degrees and can reach 90 degrees passively in some individuals with severe weakness of the capsular-ligamentous apparatus. Lateral movements in the MPJ are characteristic and functional with an amplitude of up to 40 degrees, and can be called abduction and adduction. The second finger has the greatest amplitude of lateral movements and greater independence being isolated from others and termed as index finger. However, a number of biomechanical studies of hand function in daily activities (holding a toothbrush, turning a key in a lock, typing) have shown that for a patient without specific professional requirements for hand function, a smaller range of motion can perform most of the necessary tasks. This range of motion is called functional and ranges from 30 to 70 degrees of flexion. The load applied to the MPJ during a pinch grip can reach 190 N and increases significantly with a force grip. These parameters are important for choosing the method of surgical treatment and predicting the results [18, 19, 20].

The diseases of the metacarpophalangeal joint requiring surgical treatment include osteoarthritis of the MPJ (up to 65 %), post-traumatic arthritis of the MPJ (up to 15 %) and rheumatoid arthritis (up to 15 %). Gout, tumors and tumor-like diseases of the MPJ bones and purulent arthritis (up to 5 %) are not common in clinical practice. Tumor lesions include malignant neoplasms (chondrosarcoma, osteosarcoma) and benign tumors (giant cell tumor, chondromas with a pronounced destruction) [21, 22, 23]. Rheumatoid arthritis is a chronic progressive inflammatory disease with affected MPJ in 95 % of cases. Early symptoms of MPJ RA are pain and swelling due to joint synovitis. Rheumatoid synovitis can lead to degenerative changes in the bone, articular cartilage, capsular-ligamentous and muscular apparatus of the hand, MPJ stabilizers. Ulnar deviation of the fingers due to the destruction of the capsule and ligaments, muscle contracture, and palmar subluxation of the phalanges are terrible consequences for the function of the hand and the MPJ, in particular. Deforming osteoarthritis and post-traumatic arthritis are also characterized by severe pain, contractures and digital deformity [24]. The main objectives of the surgical treatment of diseases and injuries of the MPJ are presented by Adkinson et al. (Table 1) [25].

Table 1

Objectives of surgical treatment of diseases and injuries of the MPJ

Long-term goals
Relief of pain
Adequate range of motion
Joint stability
Service life
Short-term goals
Fast recovery
Low complication rate

Arthrodesis is one of the methods of surgical treatment of diseases and injuries of the MPJ. The method is practical for severe deformities and contractures of the interphalangeal joints and often an alternative to arthroplasty. Current trends in hand surgery indicate the possibility of arthrodesis only for the first metacarpophalangeal joint with the interphalangeal and first carpometacarpal joints being in good functional condition [26]. Despite the relative simplicity and cheapness of the method, arthrodesis of the MPJ of 2–5 fingers does not provide satisfactory functional results, as is the case with interphalangeal joints in a functionally advantageous position. There are more and more references in modern literature to arthrodesis of the MPJ of 2-5 fingers as a necessary measure after failed arthroplasty as reported by Mikolyzk et al. [27]. This factor and the development of bioengineering technologies and hand surgery in general, prompted the search for new methods for reconstructing small hand joints. Biological reconstruction of the MPJ has a number of advantages, such as absolute biocompatibility and a lower risk of infection. The first attempts to transplant a complex of tissues from the foot were made in 1913 and had limited clinical use due to the development of aseptic necrosis and chondromalacia. However, with the development of microsurgery, the transplantation of toe joints was used by hand and pediatric orthopaedic surgeons: direct blood supply to the joint allowed tissues to grow. The metatarsophalangeal joint of the second toe is a typical donor site for autologous MPJ reconstruction. Despite promising long-term results, this method of surgical treatment is extremely difficult to perform, requires specialized equipment and a trained team of microsurgeons. Systematic studies show a low range of motion in the MPJ after autologous reconstruction with limited potential for the technique [28, 29].

The resection and interpositional arthroplasty was the immediate precursor to MPJ arthroplasty. In the early 1940s, capsules made from a bioinert alloy of cobalt, chromium and molybdenum were used to treat post-traumatic arthritis of the small joints of the hand, based on the experience of similar surgical interventions on the joints of the lower extremities. Although a functional range of motion was achieved with low stability of the joint after this procedure that led to revision interventions – arthrodesis and amputation in some cases [30].

Joint replacement is the leading method of surgical treatment of MPJ diseases and injuries today. The first attempts of joint replacement were made in 1959 and consisted of replacing the joint with a metal implant of the associated type. Operations were performed on 14 soldiers of the active army and had satisfactory functional results at a medium term, however, the analysis of long-term results revealed complications in the form of implant fracture and severe bone resorption. Nevertheless, this prompted an increasing interest of clinicians in the development of the technique that continues to the present [31]. Historically, MPJ implants have undergone significant changes in the design, the shape of the locking mechanism and in the manufacturing materials. A detailed description of the evolution of the implants was reported by V.M. Prokhorenko et al. (2018). The authors presented an analysis of endoprostheses by generation, highlighting their design features and disadvantages [32].

The most relevant classification of existing MPJ implants presented below, reflects their functional status:

1) by limiting the degrees of freedom: constrained, semi-constrained, nonconstrained;

2) according to the type of fixation in the bone: cemented, cementless;

3) by tribological pair: metal-metal, metal-polyethylene, ceramic-ceramic, pyrocarbon, silicone.

The cement fixation is not common in small joint surgery of the hand due to typical complications encountered with the method. The minimum size and reserve of bone tissue makes revision interventions difficult after cement arthroplasty, and the thermal reaction during the polymerization of methyl methacrylate has a detrimental effect on periprosthetic bone tissue that can lead to numerous cases of bone resorption, implant subsidence and, finally, instability of the components. Cementless fixation of components is common in surgery of small joints of the hand, with the exception of cases of individual arthroplasty [33]. Silicone constrained arthroplasty is a separate chapter in MPJ surgery. Swanson ushered in a new era of small joint replacement with the development of the silicone spacer in 1966. The implant rods were designed to act as a piston inside the bone allowing for increased mobility. In 1985, metal sleeves were added to Swanson implants at the junction of the shaft and sleeve to counteract bone erosion and implant fracture, although no significant improvement was noted. To date, four types of MPJ silicone endoprostheses are widely used in hand surgery: Swanson MCP (Wright Medical Technology), Stryker Silicone MCP (Stryker Orthopedics), Neuflex MCP (DePuy Synthes), Integra Silicone MCP (Integra LifeSciences) (Fig. 1). The main differences of silicone endoprostheses since the time of Swanson include the design of the hinge component and the precurvature of the endoprostheses by 30 degrees of flexion to ensure a reduced load on the implant at rest [34, 35].

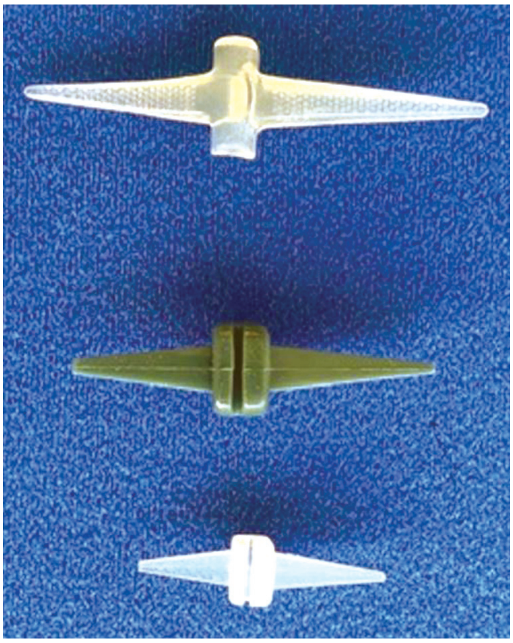

Fig. 1 Family of silicone endoprostheses of MPJ. Top to down: Swanson, Stryker, Integra

Over the past four decades, silicone implant arthroplasty has become the benchmark against which other MPJ arthroplasty implants are compared. Despite the widespread use of the implants in the treatment of patients with rheumatoid hand, the family of silicone endoprostheses has a number of formidable complications that limit their widespread recognition and use. Implant fracture is one of the main complications. Numerous clinical and experimental studies have identified 3 main types of injury to silicone implants: superficial; cracking or fragmentation of the locking part; stem fracture. The fracture rate of silicone implants ranges from 0 to 84 %. Implant survival is 74.3 % at 3 years and 67.9 % at 5 years. There is a relationship between the probability and timing of the destruction of the implant and the range of motion in the MPJ. Many researchers do not recommend the flexion over 60 degrees in order to avoid early failure of the construct [24, 32, 35]. This limits the use of these implants for patients with high demands on hand function (Fig. 2).

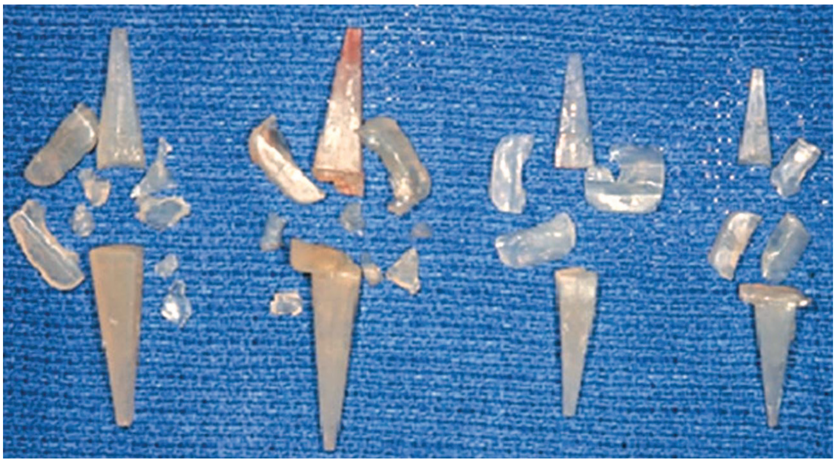

Fig. 2 Silicone implants after revision surgery for implant fracture and recurrence of ulnar finger deformity

Some studies report peri-implant bone resorption and cystic restructuring, apparently associated with the piston kinematics of the implant stem. The complications rate is about 41 % and is the main reason for poor results and revision surgery [36, 37]. Ulnar deformity of the MPJ after replacement with silicone implants is one of the causes of pain recurrence and limited functionality. The frequency of this complication reaches 58 %, although this does not always lead to patient dissatisfaction and the need for repeated intervention [38]. Peri-implant MPJ synovitis can occur under the effect of the tiny silicone fragments that are detected in tissues and cells. The adverse event leads to recurrent pain, thickening and edema of the synovial membrane, and limited range of motion that was observed in 25 % of cases [38, 39].

Summing up on the family of silicone implants, the following points can be made:

1) silicone implants fail to restore the anatomical kinematics of the metacarpophalangeal joints due to the constrained design and a higher complication rate;

2) can be indicated for older patients with severe joint deformity but are limited in use for younger patients with greater grip strength, range of motion and functional requirements for the hand;

3) decay products can lead to destructive consequences in the peri-implant bone and soft tissues.

Silicone MPJ implants remain the gold standard in the treatment of patients with osteoarthritis, however, over the past three decades, nonconstrained endoprostheses have become a good alternative to the established method. The trends in MPJ surgery have led to the use of third-generation endoprostheses, which are two nonconstrained components with cementless fixation and minimal resection of the articular surfaces [9]. Pyrocarbon (Integra) and metal-polyethylene (SRA) are the most prominent representatives.

Pyrocarbon is a unique material first used in heart valve surgery. It is formed of a gaseous hydrocarbon by pyrolysis resulting in a material with mechanical characteristics between graphite and diamond. The elastic modulus, close to the cortical bone, minimizes the effects of stress shielding. Pyrocarbon implants show excellent strength characteristics and wear resistance with a minimum amount of degradation products during cyclic loading. In addition to being bioinert, those minimal particles that result from material use do not elicit an immune response that occurs when silicone or polyethylene wear out. First used in 1979, the pyrocarbon MPJ implants underwent changes before reaching the current design. The design of Integra pyrocarbon implants is based on the anatomical, biomechanical and surgical aspects of the metacarpophalangeal joint. The center of rotation of the joint is palmarly displaced, and the design of the articular surfaces involves minimal resection while preserving the capsular-ligamentous apparatus. This implant is available in six sizes (Fig. 3) [35, 40].

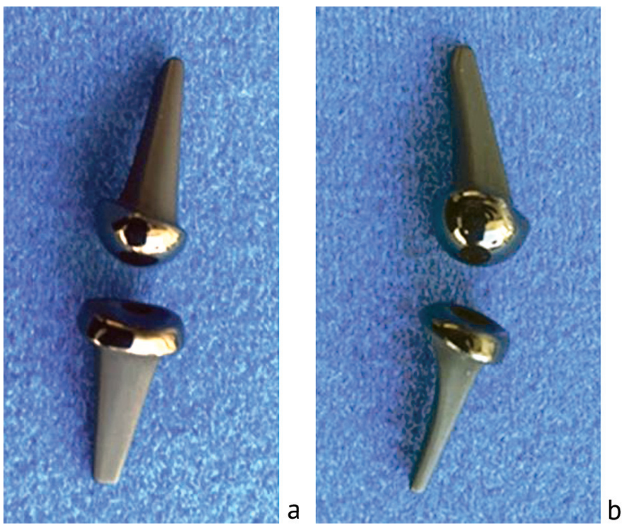

Fig. 3 Integra pyrocarbon endoprosthesis: (a) front view; (b) side view

Literature review showed that the complication rate after joint replacement with pyrocarbon implants is higher than that with silicone endoprostheses. Cummings et al. reported 124 cases of MPJ arthroplasty and revision surgery was required in 15 % of cases at 3 years with overall reoperations performed in 29 % during the follow-up period of 10 years. The total number of complications was 34 % [41]. Dislocation and subluxation, periprosthetic fracture, and joint stiffness were the main reasons for revision surgery after arthroplasty with pyrocarbon implants (Fig. 4). Wanderman reported dislocation detected in 37 cases (4 %) out of 816 MPJ arthroplasty and closed repair of the dislocation did not lead to persistent improvement. The cases of complications required reoperation with soft tissue reconstruction and implant replacement [42].

Fig. 4 Radiograph of the third MPJ after replacement with a pyrocarbon implant. The black arrow marks the line of a periprosthetic fracture of the proximal phalanx that occurred 2 weeks after implantation.

The risk of a periprosthetic fracture occurs even intraoperatively and is observed in 3 % of cases. This complication occurs with use of the "press-fit" component into the prepared bone marrow canal [43]. The lack of osseointegration on the polished stem surface is a disadvantage of pyrocarbon implants resulting in instability. Analysis of radiological observations showed that implant subsidence occurs in 80 %, bone erosion in 35 %, and a progressive lumen rim at the implant-bone interface in 9 % of cases. However, these radiological findings do not always correlate with clinical results, but are a serious prerequisite for the development of the acute conditions described above [44]. With all the advantages, the high rate of complication and revision interventions, as well as the high cost of pyrocarbon implants place limitations to the use of this type of MPJ implant.

Metal-polyethylene endoprostheses SRA implants (Styker) have a metacarpal component made of a porous alloy of cobalt and chromium and a phalangeal component made of ultra high molecular weight polyethylene (UHMWPE). It is a ball-socket endoprosthesis like the pyrocarbon implant that reproduces the anatomy and kinematics of the native MPJ to a greater extent than the silicone construct. The head of the metacarpal component narrows in the dorso-volar direction enhancing stability at MPJ flexion. The difference with the pyrocarbon endoprosthesis is that there are radio-ulnar extensions that provide stability in the frontal plane and prevent the potential tendency to radial or ulnar deviation of the fingers. The stem of the proximal component has anti-rotational extensions for easier insertion. Both cemented and cementless fixation is available. The distal phalangeal component made of polyethylene, is installed with cement. Despite the fact that this implant is inferior to the strength and tribological characteristics of pyrocarbon, the metal-polyethylene endoprosthesis showed good results in preclinical tests, and advances in cross-linking of polyethylene minimize the amount of decay particles (Fig. 5) [9, 25] , 35].

Fig. 5 Stryker SRA metal-polyethylene implant: (a) front view; (b) side view

Claxton et al. reported 17 cases of MPJ arthroplasty with the implant described with complications observed in 13 cases (65 %) with a median time of occurrence of 20 months (range, 0 to 75 months). The complications were multiple in 4 cases, and reoperation was caused by stiffness (n = 3), subluxation/functional instability (n = 3), soft tissue contracture (n = 2), heterotopic ossification (n = 2). The 10-year implant survival rate was 79 %, which is an excellent result of treatment with this still controversial method. The authors also focused on the significant difficulties of revision intervention associated with cement components fixation [45]. This is confirmed by the aspects mentioned above in this review.

Both pyrocarbon and metal-polyethylene endoprostheses show satisfactory functional results under certain clinical conditions, which can be identified as indications for the use of the implants:

1) young age of patients (up to 55 years) with high demands on hand function;

2) adequate condition of soft tissues;

3) the possibility of minimal resection to ensure the intact MPJ stabilizers, primarily collateral ligaments;

4) non-inflammatory nature of osteoarthritis.

The worst results reported by Claxton et al., were observed with use of unconstrained pyrocarbon and metal-polyethylene implants in patients with an inflammatory nature of the disease (rheumatoid arthritis), poor condition of the soft tissues and capsular-ligamentous apparatus, severe deformity of subluxated MPJ (aggravating the condition of the main joint stabilizers) and compromised bone tissue of peri-implant areas. Revision arthroplasty was required in 15 % of cases, and reoperations were performed in 29 % [46]. Despite high strength and tribological characteristics, neither pyrocarbon nor metal-polyethylene endoprostheses provide a significant increase in range of motion after surgery. Aujila et al. reviewed over 800 studies and reported an average increase in range of motion of 13 degrees with pyrocarbon implants [9].

Bioengineers and clinicians are interested in ceramic granules as a material. The characteristics of the material including wear resistance, bioinertness and biocompatibility, high corrosion resistance have been used in dentistry, surgery of large joints. Many endoprosthetic surgeons consider the “ceramic-ceramic” friction pair to be the best among the existing ones with high functional outcomes of knee, hip and shoulder joint replacement [47]. Aluminum and zirconium oxides have also explored and used in additive orthopaedics, which significantly expands the potential of unique material [48]. There are few reports on the use of ceramic endoprostheses in hand surgery and MPJ, in particular. Goryakin M.V. et al. reported a case of successful endoprosthetic replacement of the second MPJ in the acute injury with a satisfactory functional result at a short term [49]. The largest Russian study of ceramic hand implants applied to 81 joints was reported by Muradov M.I. et al. The authors note a persistent increase in range of motion from 16 to 73 degrees and a high percentage of patient satisfaction – 82 % [50]. Ceramics in small joint surgery of the hand are represented by a line of Moje Keramik Implantate unconstrained implants. The data on the long-term results of arthroplasty are still insufficient, and there is controversy among the reports. In our opinion, the existing ceramic endoprostheses of the hand joints require construction improvements.

The metacarpophalangeal joint plays a significant role in the biomechanics of the hand grip. The spectrum of nosological forms affecting the MPJ encourage the search for optimal methods of surgical treatment. Endoprosthetic replacement of the MPJ is the method of choice. Evolving from non-physiological methods of treatment, MPJ arthroplasty has undergone significant changes over more than sixty-year history. A variety of implants and manufacturing materials allowed for a surgical solution for a particular case, determined the indications and contraindications for their use. However, there are cases of negative results of arthroplasty in the form of inflammatory reactions, persistent pain and stiffness. Literature review showed a wide range of complications in the form of periprosthetic fractures, fractures of endoprosthetic components and dislocations. The variety of hand functions, its precise movements dictate high demands on the results of treatment.

This review of the literature allowed for highlighting the topical issue of hand surgery – metacarpophalangeal joint arthroplasty. The main historical milestones were identified with the current state of the problem outlined. There is a need for new construction solutions in metacarpophalangeal joint arthroplasty, introduction of new materials with the issue being relevant for research and practical use.

CONCLUSION

1. Treatment of diseases and injuries of the metacarpophalangeal joint is an integral part of the complex restoration of hand function. The MPJ arthroplasty is the most effective option among the existing methods of treatment.

2. Current trends in MPJ arthroplasty are aimed at anatomical adaptation of implants, minimal bone resection and preservation of the capsular-ligamentous apparatus, the main stabilizer of the joint.

3. Despite more than half a century of evolution, there is a high complication rate of MPJ arthroplasty with controversy regarding functional results. Improved construction solutions and materials for metacarpophalangeal arthroplasty, friction pairs exhibiting optimal tribological performance are essential for promising results with ceramic joint replacement.

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