Arthroplasty of the small Joints of the hand

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Contents

List of Abbreviations

Abb.	Complete sentence
CMC	Carpometacarpal.
CoCrMo	Cobalt-chromium-molybdenum.
DIP	Distal interphalangeal.
DJOA	Digital joint operative arthroplasty.
HDPE	High-density polyethylene.
ICR	Instantaneous centre of rotation.
IP	Interphalangeal.
MCP	Metacarpophalangeal.
OA	Osteoarthritis.
PEEK	Polyetheretherketone.
PIP	Proximal interphalangeal.
RA	Rheumatoid arthritis.
STT	Scahpotrapziotrapizoidal.
TMC	Trapziometacarpal.
UHMWPE	Ultra-high molecular weight polyethylene.

List of Figures

List of Tables

Abstract

The indications for joint replacement are pain and joint deformity. Osteoarthritis and traumatic arthritis may lead to joint arthroplasty, but the joint is in better condition in comparison with a joint affected by rheumatoid arthritis. A higher number of patients are expected to have implant replacement due to rheumatoid arthritis rather than osteoarthritis or traumatic arthritis.

Three catageroies of imlants are used in arthroplasty, hinged implants, flexible one-piece implants & surface replacement implants.

Arthroplasty has been successful in preserving motion and alleviating pain for the distal interphalangeal (DIP), PIP, and MCP joints.

Keywords

- Hand biomechanics
- Rhumatoid hand
- Small joints osteoarthritis
- Small joints arthroplasty
- Arthroplasty complications
- Types of implants
- Hand rehabilitation.

Chapter one: Introduction

Our hand is not only for grasping and feeling. It is also a means of communication and is of major importance for body language and social contact. Therefore pain, swelling, and deformity of hand, with impaired mobility and sensitivity, represent an important medical and social disability.

The metacarpophalangeal (MCP) joint is the articulation between the metacarpal and phalange bones of the hand. The MCP joint is critical for finger positioning and hand function.[4] The TMC joint is a biconcave convex double saddle joint with a permissively loose capsule.

It differs from other saddle joints by having a characteristic movement which is opposition due to laxity of the capsule of the TMC joint which permit flexion, extension, abduction and adduction in combination with some rotatory motion. The MCP, PIP, CMC joints are frequently affected by arthritis, which leads to great pain and disability. Joint replacement implants are commonly used to replace the diseased joint, but they have had varying success.

Arthritis of the hand encompasses a variety of disorders. They can be classified as inflammatory (e.g. rheumatoid arthritis) or non-inflammatory (e.g. osteoarthritis and traumatic arthritis). Rheumatoid arthritis

is the predominant type of arthritis affecting the human hand joints, [5] while osteoarthritis in the small joints of the hand is less common than in other joints such as the hip and knee.

Rheumatoid arthritis is a symmetric polyarthritis characterized by synovitis, loss of articular cartilage, and bone erosion. The bone in a rheumatoid joint has reduced bone density, reduced strength, and stiffness compared with a normal or osteoarthritic bone.[6] there is a selectivity of synovial inflammation for the small joints of the body.

Due to the joint anatomy and biomechanical factors in the pathology of the disease in the early stage of rheumatoid arthritis, there is a predominance of the disease on the radial side of the MCP joint; this asymmetry appears to tend towards symmetry over time.[7, 8]

Osteoarthritis is a non-inflammatory disease that involves articular cartilage deterioration and new bone formation at the joint edges, and usually affects one joint at a time. Osteoarthritis of the metacarpophalangeal joint is very rare, and specifically affects the index and middle fingers.[9, 10]

Traumatic arthritis is a form of arthritis caused by penetrating or repeated trauma, or by forced inappropriate motion of a joint or ligament. Posttraumatic arthritis patients are often young, and the limitations imposed by the disease affect their careers and hobbies.[11]

The indications for joint replacement are pain and joint deformity. Osteoarthritis and traumatic arthritis may lead to joint arthroplasty, but the joint is in better condition in comparison with a joint affected by rheumatoid arthritis. A higher number of patients are expected to have implant replacement due to rheumatoid arthritis rather than osteoarthritis or traumatic arthritis.

A number of strategies have been used in developing joint replacements for the MCP. The most common over the last 40 years has been the Swanson silicone implant[12]. Essentially acting as a flexible spacer between the proximal phalange and the metacarpal, the Swanson implant is a single piece of silicone with stems on either side.

Alternatively, ultra-high molecular weight polyethylene (UHMWPE) implants have been used with one surface of UHMWPE sliding against an opposing surface of metal – usually steel or cobalt chromium; similar to what has traditionally been used in hip or knee implants. Such systems will press-fit the components into the bone and attempt to replicate the natural action of the joint [14]. Over time, the UHMWPE components will tend to experience wear. Aside from decreasing overall performance, wear debris released into the body can initiate an immune response from the body, causing inflammation, bone resorption (osteolysis) and loosening of the implant [15].

Similar in action to UHMWPE/metal implants, pyrolytic carbon, or pyrocarbon, implants have been