Arthroplasty in Orthopedics and its Relation with Ortho-Biological

Artroplastias em Ortopedia e sua Relação com Orto-Biológicos

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Introduction

Osteoarthritis is a pathology that has always been described in the human race. It is defined as mirror wear of two joint surfaces with cartilage abrasion and visible subchondral bone.

There is evidence of the existence of arthrosis in the Diplodocus Dinosaur, more recently in Neanderthal Man and currently the problem persists, we can even say that the number has increased significantly, with the average increase in human life expectancy. So often that statistics of consultations in general practice reach 25% of patients, with a tendency to rise with the aging of the population. Not being a pathology exclusive to the elderly, it can also appear after the closure of the cartilages, that is, after 18-20 years of age. It can be divided into primary or structural arthrosis or secondary to external factors or pathological and traumatic antecedents. It is a pathology that biologically involves a specific cell called chondrocyte, but that later reaches the bone, synovial, ligaments and meniscus. It is currently accepted that chondrocyte dysfunction is the first link in the progression of arthrosis.

Its risk factors include deviations in the axis of the limbs, joint laxity, obesity, smoking and alcohol consumption, functional overload, age, heredity, trauma, endocrine factors and synovitis.

Its diagnosis is essentially clinical, but requires confirmation and study by radiological examinations, such as radiographs, computerized axial tomography and in some cases magnetic resonance imaging.

Early on, it was concluded that conservative treatments were ineffective and limited, whether with drugs, physiotherapy, intra-articular injections of various drugs, or more conservative surgeries, such as arthroscopy of the knee and subsequently of other joints, osteotomies with the aim of deviating axes, joint distraction, or cartilaginous tissue grafts.

Arthroplasties

Since the beginning of the 20th century, more precisely in 1923, with Smith-Petersen, when conservative treatments for arthrosis were ineffective, the need was felt to replace joints with advanced arthrosis with endoprostheses, initially with the development of joint capsules for the femoral head, which mark the appearance of the first partial arthroplasties of the hip, the joint through which arthroplasties in Orthopedics began. Later, more developed arthroplasties appeared, with Moore (1952), Bolhman (1952), Thompson (1954) and Judet (1954). But it was in 1958, with Charnley, that the first hip arthroplasties appeared with the introduction of a "cement", polymethylmethacrylate, which enabled osseointegration of the components prosthetic devices and, as such, the emergence of total hip joint arthroplasties. Years later, Muller consolidated the use of these prosthetic components.

With the development of bio engineering in collaboration with orthopedists, various investigations began, from the replacement of orthopedic "cement" by injection of hydroxyapatite on the surface of prosthetic components, which has been

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successively replaced "cement" in the osseointegration of prostheses in the bone with techniques increasingly refined.

In the case of arthrosis and in many cases of rheumatoid pathologies, it must be borne in mind that, in most cases, it has been proven that arthroplasty is necessary, the knowledge of the osteosynthesis mechanism of components in arthroplasty is a central point and it must be taken into account that not only the knowledge acquired with other arthroplasties using hydroxyapatite coating, but also the need to develop mechanisms or products that reduce the osseointegration time of the prosthesis components and, if possible, improve the quality of this same integration. So, we feel the need to develop research on osseointegration of the prosthesis components and what is the interference of coatings with hydroxyapatite, addition of platelet growth factors (PDGF) and BMP2, constituting this objective the central part of this study.

The HA coating is present today in almost all types of implant material in Orthopedics, from screws, plates, rods, prostheses, etc. Interactions occurred between this interface and the living part of the tissue, leading to chemical stabilization of the surface, important for long-term results. Until recently the topography of the material was not considered important. Despite that, recently, with the development of nanomaterials, it was observed how the surface roughness promotes important protein interactions to improve the regeneration of bone, cartilaginous, vascular or nervous tissues. The scanning microscopy we used in our experimental studies proved to be a very valuable tool for interrogating the surface material and learning about its interaction with cells.

One of the recent advances in the orthopedic material industry is the exploration of suitable scaffolds to incorporate BMP2 or other similar growth factors, to be subsequently implanted and stimulate tissue repair. Experimental work experiences reinforce this idea, not only in the quality of osseointegration but also in the quantity of this process. The results obtained demonstrate a synergistic effect between structural and biochemical properties. As such, there are advances in the improvement of osseointegration of prosthetic components using biological proteins and platelet and mesenchymal growth factors, in terms of quality and reduction of the time required for osseointegration of materials.

The components in its composition range from cobalt chromium, titanium and even more specific metal alloys such as tungsten, exploring the physical characteristics of material resistance, as well as biocompatibility.

In conclusion on biomaterials and osseointegration, hydroxyapatite represents an excellent coating material for prostheses and that the application of platelet factors enriched with PDGF to the interface of bone surface prostheses did not change the osseointegration time or the quality of the implant.

On the other hand, the morphogenic proteins, type BMP 2, revealed a power to increase osseointegration, reducing both the time required for this process, making the interface more robust, with clear evidence of improvement and quality of osseointegration.

BMP 2 morphogenic proteins, improving the quality of osseointegration of prosthetic implants, favor this process more quickly and improve the functional recovery of patients.

After the consolidation of the use of hip arthroplasties, the development of arthroplasties techniques in other joints began, with the beginning of arthroplasties of the knee, shoulder, elbow, wrist, ankle, etc, we would even say that all joints of the human body are subject to the use of these techniques.

Biologically, we can state that arthroplasties do not constitute a biological treatment for the deterioration of the central cell, the chondrocyte, but simply its replacement by metallic components, high-density polyethylene and even ceramic components, which, through a complex dynamic of functioning and osseointegration, allow you to replace a joint.

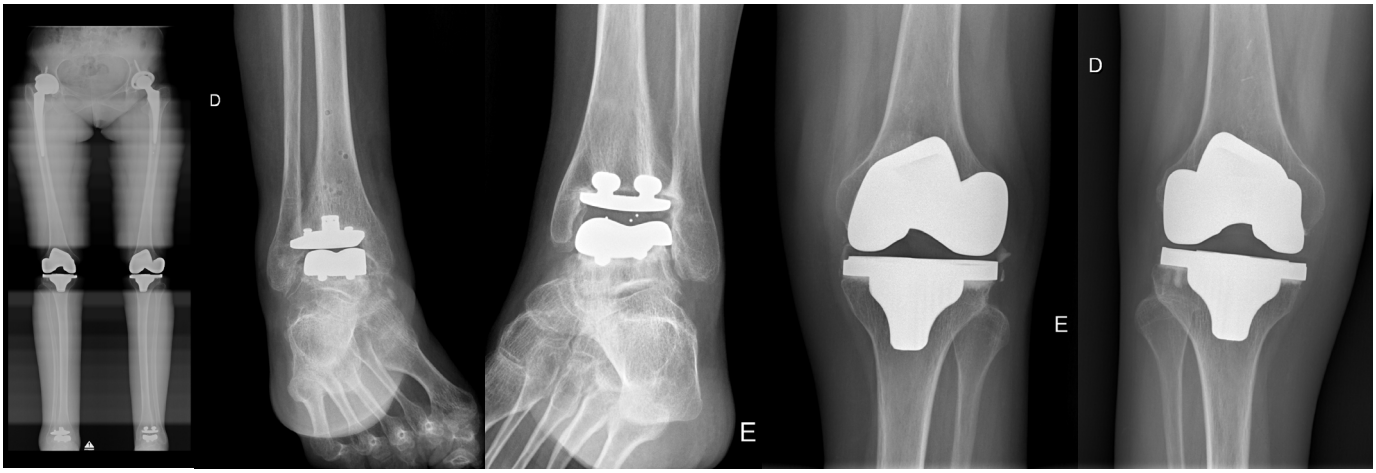
Obviously, this process brings more factors to take into account, such as the durability of the components, biointegration, infections and aseptic detachments. Arthroplasty revision techniques had to be developed, in many cases challenging the solutions found by the orthopedic surgeon, in a true imaginary spirit, supported by case-by-case experience. Despite of all, the results of arthroplasty far outweigh alternatives such as arthrodesis, that is, purely and simply "fixing" a joint, which in cases of polyarthrosis or arthritis, can determine a frank decrease in the patient's locomotion.

Pathologies such as rheumatoid arthritis, nowadays, with biological treatments with good results, constitute a challenge for the orthopedist and, of course, for the patient.

Although they are rare, there are some patients with poly arthroplasties, namely with the endoprosthetic replacement of all large load-bearing joints, lower limbs and rarer those who maintain walking capacity without external support.

To end this reflection on arthroplasties in orthopedics, we report here two unique clinical cases from our experience, both patients with severe polyarticular Rheumatoid Arthritis. The first with treatments since 1998, treated in two public hospital

units, in our previous activity, which had 8 endoprostheses, 2 hips, 2 knees, 2 ankles, one shoulder and one elbow, and the second case of a patient treated always in our Orthopedics Unit, Hospital Lusíadas Porto, currently, with prosthesis of 2 hips, 2 knees and 2 ankles, with the last ankle prosthesis performed in December 2022. The patient 4 months after surgery, is doing well, without pain and walking without the need for external support. Attached images of this last patient.



In summary, it can be concluded:

Arthroplasties are an effective treatment with excellent results, thanks to the scientific evolution of materials and osseointegration techniques.

Despite the complications described, arthroplasties are the "gold stander" in the treatment of most arthrosis.

The vast majority of joints are subject to arthroplasties.

Patients with poly arthroplasties may have walking ability and clinical improvement, which are rare in the world orthopedic scenario.

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