

KNEE IMPLANTS, RELIABLE ORTHOPEDIC APPLICATION OF COBALT-CHROME-TITANIUM ALLOY

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Abstract

Natural concern, consecutive to characteristics of osteoarthritic disease, is also getting implants with an optimal degree of morphological and functional reliability to restore patient's quality of life by balancing locomotor physiological quasi. Following these requirements, it is expected that prosthetic type of implants such as prosthetic implants for knees, to present some fundamental characteristics such as: 1) stability in complete extension and mobility during certain measure of flexion (mechanical); 2) hard, durable, corrosion resistant (physical properties); 3) biocompatibility of its component materials. There is no consensus as to which alloy material is better and more suitable for knee implants, but cobalt-chromium alloys, along with titanium, seems to be one of the most proper choices, and that is the reason of being one of the most widely used metals in knee implants, being hard, corrosion resistant and bio-compatible. The absence of fibrous type elements adherents, intraarticular, was in 3 of the 5 implants fixed with cement impregnated with antibiotic and in both cases in which cement was used without antibiotic.

Key words: knee implants, Cobalt-Chrome-Titanium alloy, Metallosis;

INTRODUCTION

The pathology of arthrosis, known ubiquitous for the progressive debilitating evolution of the musculoskeletal system, occupies an important place in the concerns of therapeutic developing, setting emphasis on both research segments, such as innovation and invention, and the one with the direct application, like surgery. (Cavalu, 2006), (Buechel, 2002)

Natural concern, consecutive to those characteristics of osteoarthritic disease, is also getting implants with an optimal degree of morphological and functional reliability to restore patient's quality of life by balancing locomotor physiological quasi. (Ouellet, 2002), (Bhatia, 2013)

Following these requirements, it is expected that prosthetic type of implants such as prosthetic implants for knees (Fig.1, 3), to present some fundamental characteristics such as: 1) stability in complete extension and mobility during certain measure of flexion (mechanical); 2) hard, durable, corrosion resistant (physical properties); 3) biocompatibility of its component materials. (Gepreel, 2013), (Long, 1998), (Niinomi, 1998)

There is no consensus as to which alloy material is better and more suitable for knee implants, but cobalt-chromium alloys, along with titanium,

seems to be one of the most proper choice choices, and that is the reason for being one of the most widely used metals in knee implants, being hard, corrosion resistant and bio-compatible. (Tharani, 2001), (Breen, 1993)

MATERIAL AND METHOD

In our study we refer to clinical and paraclinical aspects of three compartment knee arthroplasty, using different types of cement to fix the implant components (with or without antibiotic).

We have assisted 43 patients which were divided in two groups, in the first group using cement with antibiotic in composition and in the 2nd group is using standard cement, without antibiotic. Only 7 of them needed knee implant revisions, during five years (3 to 5 years after primary intervention). (Sharkey, 2002), (Fehring, 1994), (Fehring, 2001)

Inclusion criteria:

- Patient experiencing knee arthroplasty, in the past 3 - 5 years (fig. 4, 5);
- Patient that did not had painful manifestations of the knee, in the first three years postoperatively;
- Patient that presents pain to the operated knee, without being able to do any correlation with any traumatic event, postoperative.

Exclusion criteria:

- Obesity;
- Diabetes;
- Traumatic events in the operated limb;
- Joint associated imbalances of the spine, pelvis or contralateral limb.

Five of those seven implant revisions were using cement impregnated with antibiotic and the rest of two revisions on patients for which cement without antibiotic was used. The algorithm used to establish the existence loosening included clinical examination, radiography of the knee, CT scan of the knee and scintigraphy. (Font-Rodriguez, 1997)

Patients to whom these investigations have confirmed the presence of a loosening side of the cause, known or unknown, have been proposed for surgery again, this assuming complete removal of the primary implant, biological sampling for culture and re-inserting an implant with specific revision knee. (Hofmann, 2003)

Postoperatively, first moves and steps have been initiated, aided by a physiotherapist in order reshuffle osteo-articular and musculoskeletal rebalancing as quickly as possible, with the intention of re-education and re-gaining walking upright. (BARGREN, 1983)



Fig. 1. Knee implant, femoral component



Fig. 2. Knee implant polyethylene insert component



Fig. 3. Knee implant tibial component



Fig. 4. Bilateral knee radiography, preoperative;

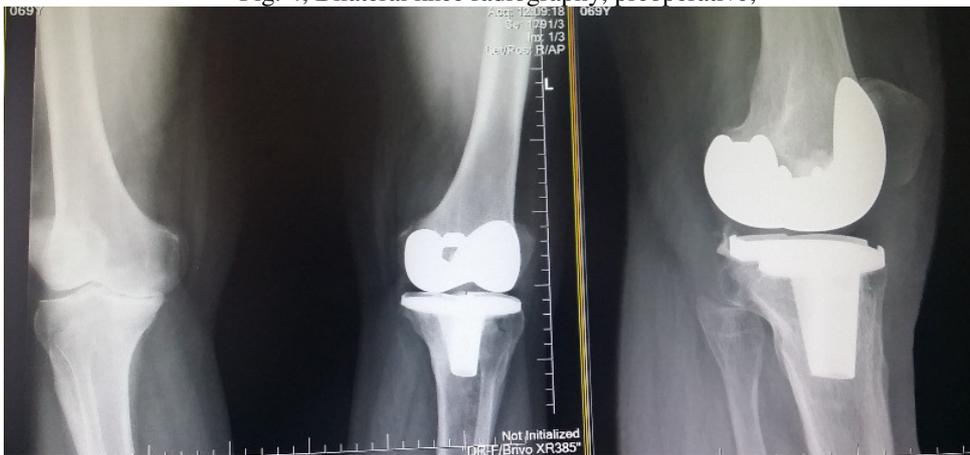


Fig. 5. Bilateral knee radiography, postoperative (left side)

RESULTS AND DISCUSSION

One of our concerns related to the use of cobalt-chromium alloys is the issue of metal ions that may be released into the body as a result of joint movement and bone – metal interaction. These particles can sometimes cause reactions in the human body, especially in case of those patients who have allergy to special metals (although the percentage of patients having such kind of allergies is very low). (Bayley, 1988)

As presented in our study, one of the seven revisions has shown macroscopic damages to the Ultra High Molecular Weight Polyethylene components and none to the metal components.

Corrosion or local microscopic reactions of the components of the implant were not reported. The evaluation with respect of local or general allergic type reaction in the first year post surgery or later, was also done, similar with other authors results. (Engh, 1992)

It has been noted the absence of secondary macroscopic reactions, metallosis type, at tissue-implant interface with all revisions implants, regardless of whether they were stabilized with cement impregnated or not impregnated with the antibiotic. (Hart, 2002), (Chew, 1998)

The absence of fibrous type elements adherents, intraarticular, was in 3 of the 5 implants fixed with cement impregnated with antibiotic and in both cases in which cement was used with antibiotic.

Bear in mind the presence of excessive, obvious, mechanical stress prosthetic components, with the liner fingerprinting, as a result of the imbalance, just intraarticular (fig. 2). (Hirakawa, 1996)

CONCLUSIONS

Long term follow up, in vivo test, showed a good clinical tolerance and a good biomechanical resistance for cobalt-chromium-titanium alloy knee implants.

These promising results recommend them for further clinical applications in knee arthroplasty and the decision of using orthopaedic cement, with or without antibiotic, was taken due to the similar biomechanical properties as we have already reported in a previous study.

It discusses what extent this antibiotic mixed with cement for fixation implants type of primary knee prosthesis, complications may influence adherence type, medium and long term, limiting progressive movements knee.

This limitation could produce a non-physiological stress of the knee, resulting in loosening of the implant, without a direct correlation with this antibiotic in cement fixation. Also, it becomes evident indirect contribution

of the antibiotic mixed with cement fixation, stabilization and durability to implant fixation flanges primary by limiting formation adherents.

The bridles can create functional imbalances with excessive mechanical stress on unforeseen aritectiural compartments, at the implant, to send excessive solicitatins, both in terms of motion vectors.

Note is the fact that one of the implants presented a mechanical degradation amid intraoperative implant malpositions, without excluding the previously mentioned adherents component .

Metallosis absence at all 7 revisions, I could not associate with the presence or absence of antibiotic cement composition, which can be subject to further research.

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