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CLINICAL REPORT

Metal ions levels measurements for early total hip replacement malfunction diagnosis with ''plasma-sprayed ceramic'' bearings couple

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Friction;
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Summary Diagnosis of total hip arthroplasty malfunction is usually based on clinical and radiographic findings, while metal ion blood levels monitoring is generally recommended for metal-on-metal bearings hip replacements. However, these measurements may be very useful in detecting anomalies in other bearing surfaces such as plasma sprayed ceramic bearings. We report on the case of a patient with a painful cementless ceramic-on-ceramic total hip prosthesis (Plasmaceram™) for which metal ions blood levels suggested revision surgery in the absence of any demonstrable radiographic anomaly. The high Cobalt and moderate Chromium ion levels in blood suggested a mechanical dysfunction of the bearing couple which revealed to be a severe cam effect requiring revision surgery of both components. Measurement of metal ion blood levels may play a substantial role in the assessment of a total hip prosthesis mechanism when using another bearing surface than metal-on-metal for which this measurement is usually recommended.

Introduction

The measurement of blood metal ion levels in metal-on-metal [1—5] and ceramic-on-metal [6] hip replacements is highly advocated. It helps detect implant malfunction prior to the occurrence of radiographic anomalies [7—10]. Plasma-sprayed ceramic was introduced in the orthopaedic field in the mid 1990s, spurred on by manufacturers and the University Hospital Centre of Limoges [11,12]. Some failures were reported due to the dissociation of the ceramic coating

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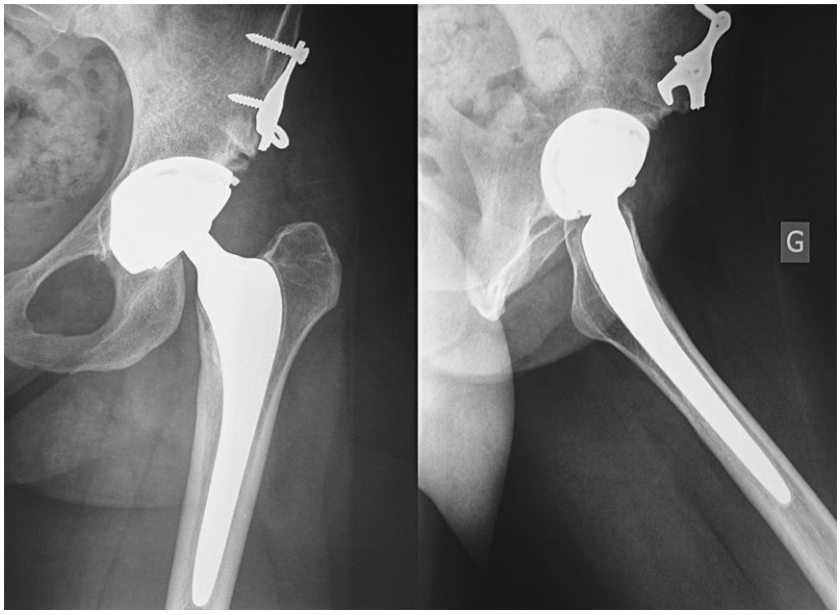

Figure 1 Radiographs revealing neither bearing surface anomaly nor osteolysis around the non-cemented Plasmaceram™ bearing surface prosthesis.

from the metallic substrate thus leading to the progressive abandon of this hard-on-hard bearing which belongs to the ceramic-on-ceramic bearings [13]. Proper control of this uncommon bearing surface is challenging and provides difficulties in revision surgery indication, particularly in the absence of any radiographic anomaly and/or when clinical symptoms are limited. We report a clinical case which demonstrates the usefulness of blood levels of metal ion measurements in this type of situation.

Clinical case

Our clinical case is a 31-year-old female patient operated on for congenital dislocation of the left hip on three occasions: surgical repositioning at the age of walking, shelf arthroplasty in 1997 at the age of 19, non-cemented revision total hip arthroplasty (Saphir™, Crystal™ prosthesis, Limoges, France) made of hydroxyapatite-coated titanium alloy (Figs. 1 and 2), performed in 1998 for evolutive osteoarthritis of the hip. The 22.2 mm hard-on-hard friction type was a ceramic-on-ceramic bearing surface ((Plasmaceram™, Crystal™, Limoges, France) with a polyethylene sandwich placed between the liner and the shell (Figs. 1 and 2). The Plasmaceram™ is a plasma sprayed hexaplasma ceramic combining chromic oxide and tungsten carbide on a titanium substrate (22.2 mm head and metal liner placed in the acetabular polyethylene sandwich). In 2004, the patient underwent a contralateral total hip arthroplasty (right hip) using a hard-on-hard bearing surface made of alumina

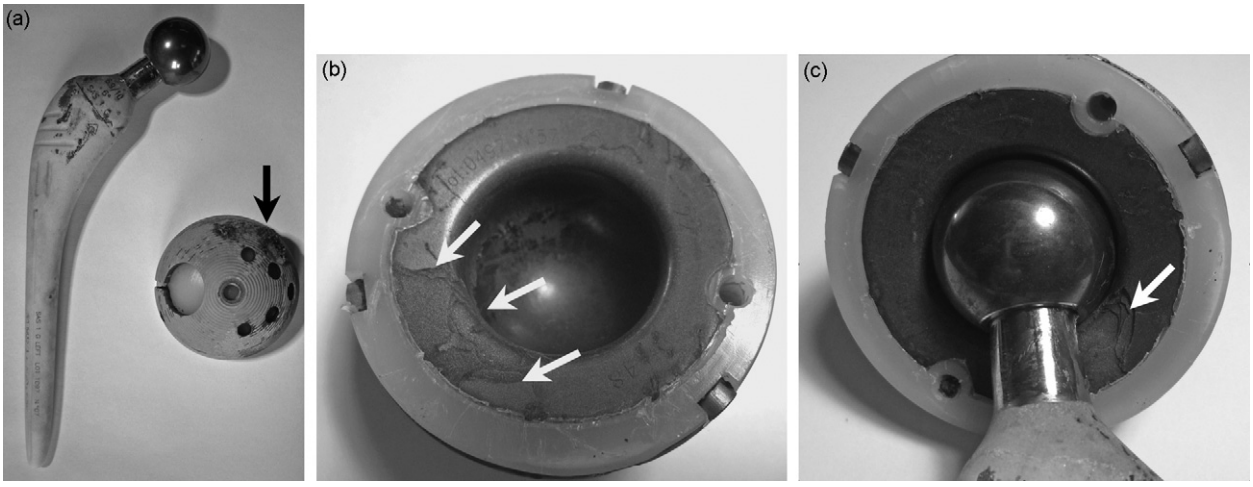

Figure 2 Appearance of the explants, the black arrow shows the osseo-integration process on the cup (a). The white arrows show the cam effect and its extent in the postero-inferior region of the cup (the white arrow on the right shows the contact between the neck and the border of the Plasmaceram™) (b). However, the prosthetic neck does not reveal any contact mark (c).