213 Acacia Ave.
Bethesda, MD 20814-2893
tel. 301-530-5146
e mail cwmcc2000@yahoo.com

Charles W. McCutchen
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Dimpled Hemiprostheses?

Weeping bearing materials must resorb fluid to replace the pore fluid they lose when under load. In natural human joints the region of contact moves as the ill-fitting cartilage surfaces slide upon each other, thus exposing region after region to free fluid.

Suppose an artificial femur head of spherical shape is used in a natural acetabulum. Rotating the femur head will not alter its fit to the acetabulum, so unless there are intervals when sphere and acetabulum are separated from each other ("distracted" is the medical term), one would expect weeping lubrication to fail.

When I was first thinking about joint lubrication in about 1960 I wondered about this problem and had an idea that so lodged in my head that I explained it to the person watching me wake up from Pentothal after a minor operation; prosthetic femur heads used with the natural acetabulum should be dimpled like golf balls. Each dimple would contain trapped fluid for the acetabular cartilage to absorb.

The dimples, which should have smoothly rounded edges, would work better than humps, because humps do not trap fluid.

(Prostheses of other shapes too should benefit from dimples' ability to transport fluid to the mating cartilage.)

I was told that when a femur head was replaced the acetabular surface was usually replaced also, so I lost interest, awaking slightly when I read of Cathcart's hemi-prosthesis whose slightly prolate elliptical head was designed to mimic the natural shape.

I recently learned that femur heads are routinely replaced after a hip fracture if the natural head has been so displaced that its blood supply is disrupted. The acetabular cartilage is left as is. Alas, a traveler for a prosthesis company told me that the cobalt/chromium of the heads is bad for cartilage. Further, I have seen a micrograph of cartilage that had been experimentally exercised against cobalt/chromium. The cells next to the surface were dead. Those deeper were not.

Perhaps ions from the metal head had poisoned the cells. A dimpled femur head might reduce such an effect because the tidal flow into and out of the cartilage in weeping lubrication would reduce the concentration of the ions.