This document appears to be a patent application for a device related to ankle joints. It includes references to previous patents and provides a description of the device. The abstract mentions that the device comprises a tibial component and talar component defining respective concave and convex surfaces of substantially complementary, open-ended, generally cylindrical form for mutual articulatory bearing engagement. These surfaces are preferably more precisely cylindrical, but may have curvature in the axial direction for added stability. Fixation is effected with gap-filling cement between the bones and low relief configurations are provided on the components remotely from their bearing surfaces.
ENDOPHOSPHETIC ANKLE JOINT DEVICES

This invention concerns prosthetic devices and, more particularly, articulatory endoprosthetic bone joint devices.

While such devices have been proposed for a number of different bone joints, none appears to have been proposed for the ankle joint. Indeed, when the natural articulation function of the ankle joint is beyond repair, the currently normal treatment is that of fusion of the joint.

An object of the present invention is to improve this last situation by the provision of an endoprosthetic ankle joint which provides articulation similar to that of the natural joint.

In a more general aspect the relevant device comprises: a tibial component and a talar component; said tibial component defining a concave surface of revolution of open-ended generally cylindrical form; said talar component defining a convex surface of revolution substantially complementary to said concave surface for mutual articulatory bearing engagement therewith; and said components being adapted, remotely from said surfaces, for respective securement to the tibia and talus.

In a presently preferred form of the proposed device, the bearing surfaces are cylindrical and the securement adaption involves the provision of low-relief formations on each component. Use of this preferred form of device involves suitable excavation of the tibia and talus to receive the tibial component in the tibia with the longitudinal axis of the component extending between the tibial medial malleolus and the fibular lateral malleolus, and to receive the talar component in a similarly orientated contiguous position in the talus. These dispositions of the components and the associated bones form a mortise-like structure similar to that of the natural joint and also having a similar articular function. The components are secured in these dispositions with the use of acrylic or equivalent gap-filling cement and the low-relief formations assist in this by providing a key for the cement.

In order to provide a fuller understanding of the invention, the same will now be described, by way of example, with reference to the accompanying drawings, in which:

FIGS. 1, 2 and 3 illustrate the tibial component of the initially developed embodiment of the invention in respective underneath plan views and mutually orthogonal side elevations.

FIGS. 4, 5 and 6 similarly illustrate the associated talar component of this initial embodiment.

FIGS. 7, 8 and 9 illustrate the tibial component of a further developed embodiment of the invention in respective underneath plan views and mutually orthogonal side elevations, and

FIGS. 10, 11 and 12 similarly illustrate the associated talar component of this further embodiment.

The tibial component of FIGS. 1 to 3 is denoted generally at 10 and comprises a main body in the form of a square platform 11 having one major surface 12 concavely dished to provide a part-circular cylindrical bearing surface with its longitudinal axial direction parallel to one opposed pair of sides of the platform and with circular arcuate cross-sectional profile. The other major surface 13 of the platform 11 has a subsidiary platform 14 which is also of square form, with a side length of about half that of platform 11 and projecting centrally therefrom, and has undercut sides.

The associated talar component of FIGS. 4 to 6 is denoted generally at 20 and is, in most respects, essentially the same as the tibial component in comprising a main body platform 21 with one major surface 22 serving as a part-circular-cylindrical bearing surface, and the other major surface 23 having an undercut subsidiary platform 24 extending integrally therefrom. However, a principal difference from the tibial component is that the bearing surface is convexly formed to be complementary with that of the tibial component.

Another difference between the two components lies in the fact that it was preferred to make the tibial component of metal, suitably an appropriate quality stain- less steel, and the talar component of plastics material, such as high density polyethylene. Such a choice of materials was considered advantageous in affording the low friction characteristics of a metal/plastics material combination, while allocating the use of metal, with its lower susceptibility to wear, to the concavely dished tibial component so that this component need not require undue penetration into the bone simply for the purpose of providing a satisfactory component thickness.

Securement of the components of FIGS. 1 to 6 is effected in the manner described hereinbefore, it being understood that the undercut subsidiary platforms 13 and 24 provide the relevant low relief structures for this purpose.

It remains to note in respect of the components, that the bearing surfaces 12 and 22 should, of course, be of like curvature, and they should preferably be of such circumferential extent as to provide an angular range of mutual articulation of the same order as that in the natural joint, namely, 50°–70°. In a prototype of this initial embodiment each of the main bodies 11 and 21 is substantially 1 inch square, and the radii of curvature of the surfaces 12 and 22 are substantially thirteen-sixteenths inch.

Turning to the further developed embodiment of FIGS. 7 to 12, the tibial component is denoted generally at 30 and comprises a main, square platform body 31, with one major surface defining a part-circular-cylindrical concave bearing surface 32 extending parallel to one opposed pair of sides of the body 31, and with the other major surface 33 provided with a relatively low relief configuration. This component will be seen to be similar to that of FIGS. 1 to 3 except for the relief configuration. In this case the configuration comprises a stud 34 projecting from the surface 33 adjacent to and midway along one periphery thereof parallel to the axial direction of the surface 32. In addition, this configuration comprises the provision of four bores 35 extending partway into the body 31 in respective corner regions of the surface 33.

The associated talar component is denoted generally at 40 and comprises a main, rectangular platform body 41, with one major surface defining a part-circular-cylindrical convex bearing surface 42 extending parallel to the shorter opposed pair of sides of the body 41, and with the other major surface 43 provided with a relatively low relief configuration. The radius of curvature of the surface 42 is equal to that of surface 32 so that these surfaces are complementary for mutual articulatory bearing engagement about a common axis of revolution for the relevant surfaces. This arrangement
is similar to that of the initial embodiment, but a difference arises in that the bodies 31 and 41 are respectively square and rectangular, surface 42 of the latter having greater extent in the direction of revolution, but similar axial extent, compared to surface 32 of the former. The greater extent in question allows mutual articulation between the components to occur over a requisite angular range while maintaining the whole of the surface 32 engaged with surface 42. This is advantageous in that the area of bearing engagement is substantially constant throughout articulation to spread the bearing load and reduce wear. At the same time, it is now preferred that the talar component be made of metal, and the tibial component be made of plastics material, whereby there are no exposed "edges" of metal involved in the mutual articulatory engagement, and this is desirable to further reduce possible wear and also the risk of pain in the event that a metal edge should bear movably and directly against the bone.

The low relief configuration of the talar component 40 comprises a stud 44 projecting from the surface 43 adjacent and midway along one of the axial peripheries, and two bores 44 extending partway into the body 41 from respective locations as shown in Fig. 10.

In practice, the surgical procedure preferably involves the use of a template and drill to provide bores into the prepared bone sites, the locations of which bores coincide with the positions the studs 34, 44 and bores 35, 45 are to assume. Cement is then applied to the sites and the studs 34, 44 entered into their corresponding bone bores to locate the components whereby cement enters the then aligned component and remaining bone bores. This procedure effectively provides opposed cement stems extending into the components and bones.

While the invention has been described with reference to the illustrated embodiments, it is not intended to be limited thereby and can take other forms within the ambit of the appended claims. For example, the bearing surfaces need not necessarily be cylindrical, but may have complementary curvature in their axial directions to provide enhanced lateral stability in the prosthesis. Also, other forms of low relief structures can be employed.

A further possibility for modification arises from the discussion of possible risk of pain above. This risk is thought to arise with direct engagement between a bone and a relatively movable component, particularly if the component is metal and if the bone has deteriorated as can be the case with one malleolar in an ankle joint requiring a prosthesis. It may be appropriate therefore to provide at least one malleolar component to serve as a buffer between the talar component and one or both of the malleoli. Thus, there may be two separate malleolar components for separate fixation to respective malleoli, or just one such component. Alternatively, such components may be provided as integral extensions of a plastics material tibial component to be cut off or not as appropriate to the situation at hand.

We claim:

1. An endoprosthetic ankle joint device comprising: a tibial component in the general form of a first rectangular block having one side grooved to define a concave surface of substantially part-circular cylin-