THE MOVEMENTS OF THE COMPONENTS OF THE HASTINGS BIPOLAR PROSTHESIS

A RADIOGRAPHIC STUDY IN 65 PATIENTS

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We aimed to find out whether the Hastings bipolar prosthesis moved in a bipolar fashion after its use for displaced fractures of the femoral neck. In 65 patients non-weight-bearing movement was assessed radiographically and compared with an earlier study of the Monk prosthesis.

In 70% of patients, the only movement was between the acetabulum and the prosthetic shell, the prosthesis behaving as if it were unipolar. This did not change with time, but there was a slight improvement in the range of movement, particularly in flexion. The absence of movement between the outer shell and the metal head is most probably due to the design of the prosthesis and makes this prosthesis unsuitable for use in osteoarthritic hips.

We have shown that in bipolar prostheses like the Monk hard-top “duo-plet”, movement takes place both between the acetabulum and the metal shell and between the high density polyethylene cup and the metal head (Chen, Sarkar and Pell 1980). We now report our study of another bipolar prosthesis.

The Hastings bipolar prosthesis (Fig. 1) had replaced the Monk prosthesis for use in our trauma service in January 1984 for a number of reasons:
1. The sizes of the metal shell ranged in stages of 1 mm so that more accurate replacement of the femoral head could be made.
2. The femoral stem was smaller in cross-section, making insertion easier.
3. The shells were sterile-packed separately, and there was a common femoral stem and metal head. This reduced the cost of stocking with the full range of prostheses. At first, it was sometimes difficult to snap the prosthetic shell onto the metal head, and we also feared dislocation, but this was not seen. The femoral stem with its small head was easier to insert.

PATIENTS AND METHODS

Sixty-five patients with displaced subcapital fractures of the femur admitted to the Enfield district hospitals between January 1984 and July 1986 were included.

They usually had their operation within 48 hours of admission. This was standardised using an anterolateral (Watson-Jones) approach. The femoral head was measured with calipers so that the prosthesis chosen was of the same size, the neck was trimmed and the medullary cavity prepared. The femoral stem was cemented with polymethylmethacrylate, and once this had hardened, the prosthetic shell was snapped onto the metal head of the femoral stem. This has to be done at an angle, since it does not snap into place if pushed along the axis of the neck. The patient sat out of bed after one day and walked with a Zimmer frame after two to three days.

Fig. 1

Hastings bipolar prosthesis, with a radiograph to show the two metal components.

Fig. 2
All radiographic studies were carried out in Highlands Hospital, using image intensifier screening at approximately 100 kV. Radiographs were made at 120 kV in order to penetrate the metal shell, and allow the two metal components of the prosthesis to be clearly distinguished (Fig. 2). The patient lay supine, and the pelvis was positioned before screening. The patient was then asked to flex, abduct and rotate the hip (Figs 3 to 7). Movements of the metal shell and of the metal head of the femoral component were observed and were measured with a goniometer.

Flexion was recorded as the angle between the thigh and the table, abduction and adduction by the angle between the thigh and the longitudinal axis of the body. Rotation was recorded as the angle subtended by the patella in the neutral and rotated positions. The end of each movement was marked by tilting of the pelvis, as in clinical examination of the hip. The onset and extent of movement between the components of the prosthesis was noted and the total range for the whole prosthesis was recorded. Observation was easy, as slight movement of either component was easily detected on the image intensifier screen. Rotational movements were also easily detected by tilting of the metal shell, which indicated the starting point of movement between the metal shell and acetabulum. Purely rotational movements of the shell never occurred because test axes were never completely in line with the axis of the femoral axes (Last 1978). Extension was studied with the patient lying prone and raising the thigh, making certain that the pelvis had not moved.

RESULTS

There were eight men and 57 women with an average age of 79.7 years (range 53 to 94). Prosthetic replacement had been carried out for Grade III and IV fractures (Garden 1961) and review took place from two months to 26 months postoperatively (Table I). One woman had both hips operated on, and eight patients were reviewed on two occasions. Most of the hips were seen to move at the acetabular-prosthetic interface only, with no movement between the shell and the metal head.

Of the 36 hips reviewed at two to five months, 24 hips showed movement only between acetabulum and prosthetic shell and 12 moved at both surfaces. At six to 11 months, 10 hips had only acetabular movements and five moved at both surfaces. The results for longer review periods are given in Table I.

DISCUSSION

A total of 74 hips were examined, one patient having bilateral replacement and eight having two screenings. Of these, 52 hips (70%) had movements only at the acetabular interface and 22 at both surfaces. In none of the eight patients examined twice was there a change in the result.

There was some improvement in range of movement, and especially in flexion, in patients at a later stage. This is to be expected since all prostheses have a "running-in period". Extension was poor in almost all hips.

It is disappointing that in 70% of the hips the only movement was between the acetabulum and the prosth-

![Fig. 3](image1.png) ![Fig. 4](image2.png) ![Fig. 5](image3.png) ![Fig. 6](image4.png) ![Fig. 7](image5.png)

The Hastings prosthesis in one case. From left to right: flexion, abduction and adduction, internal and external rotation.
tic shell. This defeats the purpose of the bipolar type of prosthesis, and the result is in sharp contrast to the Monk hard-top "duo-plee" prosthesis in which movements do take place at both interfaces (Chen et al. 1980). It may well be that the loss of movement between shell and head is due to a wedging effect; the metal sphere of the Hastings prosthesis is less complete, while in the Monk prosthesis the head remains spherical almost to the neck (Figs 8 and 9).

Another difference is that the thickness of high-density polyethylene in the Hastings design is greater at the periphery than at the apex, the metal head being well recessed in the shell to give a range of movement of only 48° (Devas and Hinves 1983). This depth also means that the centre of movement of the metal head does not coincide with that of the shell.

The size of the metal head is not as important as its sphericity and its arc of movement (Krein and Chao 1984). The view that movement at both interfaces is advantageous has been questioned (Cabanela and VanDemark 1984) although these authors admit that the clinical results are better than those with conventional prostheses.

Our results appear to confirm those of Phillips (1987) with the Bateman prosthesis where the main movement was also between the acetabulum and the shell in fracture patients, and remained the same over a four-year period. Verberne (1983) also observed that the inner bearing became stiff by three months. Phillips differentiates between the movement in fracture and osteoarthritic groups, attributing this difference to the absence of normal articular cartilage in osteoarthritic patients.

We consider that prosthetic design may influence these results. Lack of movement between the prosthetic shell and the head make the Hastings bipolar prosthesis unsuitable for use in osteoarthritic hips.

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Fig. 8

Fig. 9

To show the shape of the metal head of the Hastings prosthesis and (Fig. 9) the more complete sphere of the head of the Monk prosthesis.

REFERENCES


