

[54] **FEMORAL SHAFT SURGICAL RASP FOR USE IN HIP PROSTHESIS SURGERY**

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[58] Field of Search 128/305, 92, 312, 83; 3/1

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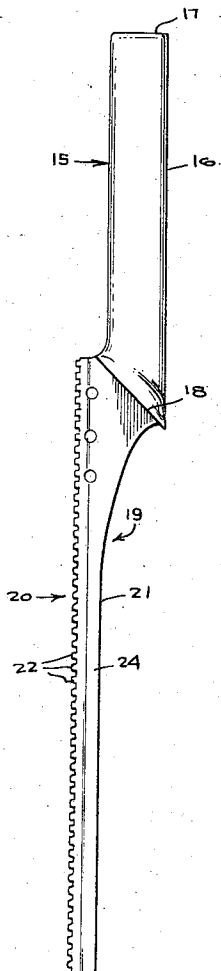
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[57]

ABSTRACT

A femoral shaft surgical rasp for forming a canal in an amputated femur shaft for reception of the elongated shank of a femoral prosthesis head member in the femur in performing hip prosthesis surgery, wherein the rasp has a working portion configured like the elongated shank of the femoral prosthesis component or member providing a generally wedge-shaped zone, and has the cutting promanances of the rasp along one longitudinal edge only, with the remaining three surfaces smooth. By this design, damage to the abductor muscles and/or soft tissue which are in the working path of reciprocative movement of the rasp when forming the canal is avoided, and the instrument cuts more efficiently because the smooth surface opposite the cutting edge exerts a forciful wedging action toward the bone surface confronting the cutting edge.

10 Claims, 4 Drawing Figures



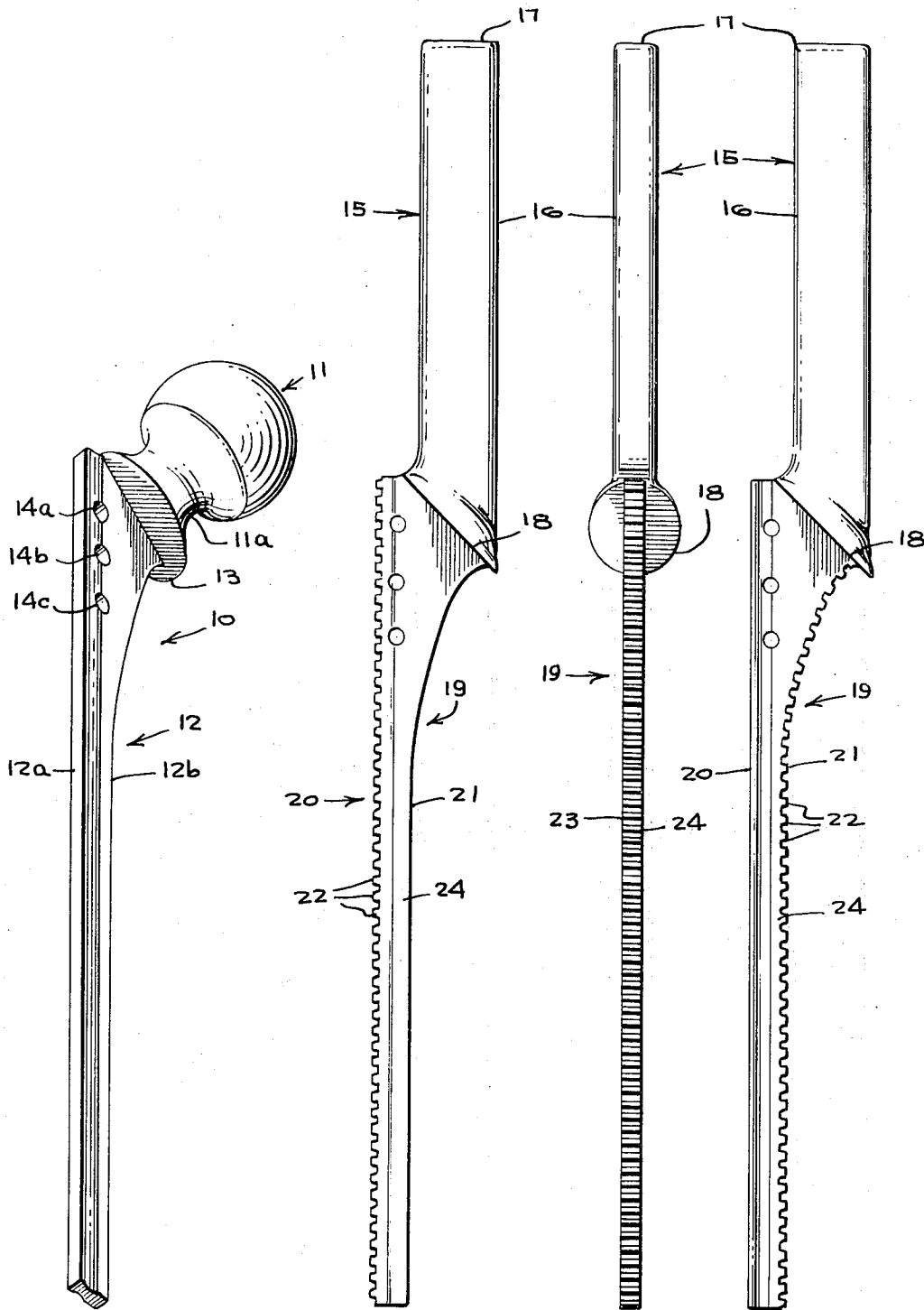


Fig-1

Fig-2

Fig-3

Fig-4

FEMORAL SHAFT SURGICAL RASP FOR USE IN HIP PROSTHESIS SURGERY

BACKGROUND AND OBJECTS OF THE INVENTION

The present invention relates in general to femoral shaft surgical rasps for use in forming an elongated canal in the femoral shaft of the thigh bone after amputation of a portion of the femur, into which a femoral or head prosthesis member is inserted and fixed in the course of performing total and subtotal hip prosthesis surgery.

Heretofore, total hip prosthesis surgery has been performed wherein a prosthesis cup is fitted in the acetabulum, and a femoral prosthesis member or head prosthesis member, forming the femoral component of the total prosthesis, which comprises a stem or shank portion and an artificial head, is fixed in the femur shaft to provide a prosthetic hip joint. The fixation of the shank portion of the prosthesis (the head member) in the shaft of the femur has been attempted by forming an appropriately shaped canal or seating recess in the femur shaft and cementing the shank in the femur shaft, or by forming the canal, inserting the prosthesis shank, and drilling and installing bolts transversely through the femur shaft and the prosthesis shank. Considerable difficulties have been encountered in properly forming the canal in the femur for receiving the shank of the femoral portion or head prosthesis member in proper position in the femur shaft with rasps of conventional construction having the cutting prominences on all four surfaces of the rasp as in the case of the typical rasp used in the Harris total hip system (the components of which are advertised and sold by Howmedica, Inc. of Rutherford, N.J.), because of the proximity of soft tissue, such as the abductor muscles, to the path of reciprocative movement of the cutting portion of the rasp. Many surgeons detach the abductors from the greater trochanter to be able to move the abductors away from the path of the rasp so as to avoid damaging them, but the detachment of the abductors adds an additional approximately six weeks to recuperation time.

Also, previous rasps have the cutting teeth on all four sides and therefore did not allow the surgeon to select the direction of maximum cutting. The direction of this cutting can be critical in proper seating of the prosthesis or total hip, especially if there has been previous surgery. This is often the case, since many of these total hip prosthesis procedures are done as salvage procedures of old hips with many previous attempts at surgery.

An object of the present invention is the provision of a novel femoral shaft surgical rasp construction for use in performing total and subtotal hip prosthesis surgery, wherein the working portion of the rasp is in the shape of the shaft portion of the femoral prosthesis member, and has cutting prominences along one edge only of the working portion so as to present smooth surfaces in the other three directions to avoid traumatizing abductor muscles which are still attached to the femur and similar soft tissue and facilitate control of the cutting action.

Other objects, advantages and capabilities of the present invention will become apparent from the following detailed description, taken in conjunction with

the accompanying drawings illustrating a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is a perspective view of the femoral component of a total hip prosthesis, to which the present invention relates;

FIG. 2 is a side elevation view of the femoral shaft surgical rasp of the present invention having the cutting prominences along only the straight rear side of the rasp;

FIG. 3 is an elevation view thereof, viewed from the left hand side of FIG. 2; and

FIG. 4 is a side elevation view of another form of the femoral shaft surgical rasp, having the cutting prominences along only the concavely curved front side of the rasp.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

To facilitate understanding of the use of the femoral shaft rasp of the present invention and the advantages of the design, the technique for insertion of the total hip prosthesis by the lateral approach will first be generally reviewed. After the fascia has been opened and the trochanter with its abductor muscles identified, abductors are carefully delineated from the capsule, working from anterior to posterior and posterior to anterior, so that the capsule is separated in its entirety from the abductors. The abductors are left attached to this proximal tip of the trochanter. The proximal tip of the trochanter is carefully osteotomized to avoid any fracture of the distal stock of the femur, which osteotomy may be accomplished with a power saw. A piriformis is frequently attached near the osteotomy site and this is released, and the external rotators which are usually attached partially to the released portion of the trochanter and partially to the distal femur, are individually released. The anterior capsule and the expansion of the origin of the rectus femoris are identified and removed with the cutting cautery. The lateral capsule is separated from the few fibers of the abductor muscles and it also is removed with the cutting cautery. The capsule is delineated carefully from the rectus femoris and the medial portion of the capsule is removed. The posterior capsule is then removed with the cutting cautery.

The head and neck of the femur are removed directly in a transcervical direction by amputation perpendicular to the middle portion of the neck with either a power saw, Gigley saw, or a sharp osteotome, taking care not to fracture the distal stock of the femur. This initial amputation is not the site of the final seating of the femoral prosthesis but tends to be on the high side just below the cartilage of the femoral head. Using the conventional template for the cup member of the total prosthesis, the position of the cup is checked to see how the cup will seat at a 30° angle. The conventional acetabular index template is used to determine the 30° angle, and the degree of reaming that will be necessary is determined at this point. Making every effort to protect the lateral quarter of inch cartilage in the acetabulum, the cartilages are removed with sharp dissection in the reaming portion of the acetabulum. After the cartilage has been removed, small reamers are used to gradually ream the recipient acetabulum to accept the cup.

The acetabular index template is reinserted at intervals to determine the proper fit for the cup. A template is used to start the slots for the phalanges on the cup. A sharp instrument is then used to deepen these to appropriate depths. At least three screws for fixing the cup in the acetabulum are then inserted.

Previous orientation with simple prostheses and cups have tended to err on the side of a loose fit. However, the exact opposite is true with the total hip prosthesis, as an extremely tight fit is essential. In order to obtain a tight fit, an estimate should be made of the amount of the neck of the femur to be removed to obtain this fit. Then slightly less than the estimated amount should be removed in the initial amputation step previously described. This must be done with power instruments in order to avoid fracture. The final amputation site of the neck should then be carefully marked. This may be done with a template in the form of a trial prosthesis member, for example having a removable head corresponding to the head of the actual femoral prosthesis member to be used, and having three holes corresponding to the exact angle of the flange at the base of the neck and head of the prosthesis. The head on the trial template is placed in the acetabulum with the body portion of the template parallel to the femur shaft. An assistant pulls down firmly on the shaft of the femur to give the maximum length for a very tight fit. Drills are inserted through these holes perpendicular to the neck to mark the final amputation site of the neck, and the final amputation is performed with a power saw or osteotome. This is approximately one finger breadth above the lesser trochanter. Prior to the final amputation it is important to identify the most inferior portion of the neck and calcar-femorali and mark it using the cutting cautery. This will usually be found to be slightly anterior to the lesser trochanter and should be marked down to at least as low as the lesser trochanter, regardless of how much neck is removed, the proper line for the inferior edge of the prosthesis will always be visible. This marking may also be accomplished with the use of the burr on an air power instrument.

Prior to any of this surgery in the region of the abductors, a wet lap sheet is placed from the anterior portion of the wound through the posterior portion of the wound around the abductor muscles. This identifies and protects them throughout the procedure. It is well to have this during the preparation of the acetabular portion also as the wet lap sheet around the deltoid tends to hold moisture in these muscles which could otherwise become dry and have a lowered resistance.

The rasp of the present invention is then used to form the seating recess or canal in the amputated femur shaft. The outline of the insertion of the prosthesis shank is then marked, in the proper plane, with a conventional osteotome or a box osteotome. The rasp, as will be later described, is one that cuts only on one side which leaves a smooth side of the rasp in contact with the abductor muscles. The rasp is advanced down the canal, using a curette if necessary to palpate the lining of the canal. The rasp is inserted at an increasing distance down the canal and then retracted and the canal cleaned out. In patients with previous surgery, a large amount of cutting at the region of the insertion will be necessary using sharp osteotomes to perform the task. Sharp cutting at this time may avoid the possibility of fracturing either the greater trochanter or the calcar-

femorali by attempting to use a rasp in those cases where there is an increase of cortical type bone in the region of the trochanters. This is particularly true in those patients who have had previous surgery, either osteotomies, bonegrafts, or other bony surgery in the region of the hip. An x-ray on the table before closure will avoid a misplacement of any of the components.

The configuration of the femoral component or head member of the total hip prosthesis which is to be installed and fixed in the amputated femur shaft is illustrated in FIG. 1 of the accompanying drawings, and is indicated by the reference character 10. The femoral prosthesis member is an integral prosthetic device comprising a head formation 11 having a neck 11a and defining a highly polished spherical head to interfit in the socket defined by the cup member of the total prosthesis, and has an elongated shank or stem portion 12 which is substantially flat, extending from the flange formation 13 at the base of the neck 11a of the head formation 11. The shank 12 includes a plurality of transverse holes 14a, 14b and 14c extending through the shank 12 near its upper end, which may be about one-quarter inch in diameter, to receive three bolts, for example 2 inch bolts of one-quarter inch diameter, designed to extend transversely through the femur shaft and accurately and precisely fix the prosthesis shank in the femur in a manner which effectively resists the torque on the prosthesis head and conveys the stress from the prosthesis member to the hard cortex without either rotary or piston like motion. The shank 12 of the prosthesis member is substantially flat and is of elongated tapering configuration having a straight inner edge 12a and a substantially concavely tapering outer edge 12b.

The rasp to be employed in reaming or forming the canal in the amputated femur shaft for receiving the femoral prosthesis shank comprises an elongated rasp member indicated by the reference character 15 in FIG. 2 or FIG. 4 including an elongated handle 16 of generally oval configuration having a butt end 17 and having an enlarged flange 18 at the opposite end thereof disposed at an angle of 45° to the longitudinal axis of the handle 16. Extending below the flange end 18 of the handle 16 is the working portion or cutting portion 19, which has the same configuration as the shank portion of the femoral prosthesis member, in lateral profile, defining a straight back edge 20 and a concavely curved front edge 21. The straight edge 20 of the working portion 19, in the FIG. 2 form, or the concavely curved front edge 21 of the working portion 19, in the FIG. 4 form, is formed with teeth or cutting prominences indicated at 22 along the length thereof. In the FIG. 4 embodiment for example, the teeth 22 will cut on the calcar-femorali side only of the amputated femur shaft. The working portion 19 of the rasp 15 is progressively inserted at increasing distances down the canal to be formed in the amputated femur shaft and is then retracted, and the canal cleaned out, until the canal is formed to a sufficient depth to permit full seating of the femoral prosthesis shaft therein. Because the edge of the working portion of the rasp 15 opposite the toothed edge, as well as the lateral sides 23 and 24 thereof, are smooth, there are no teeth directly confronting the very important abductors which remain attached to the greater trochanter so that chewing up, damaging or traumatizing these abductors is avoided. Furthermore, the rasp cuts much more effi-

ciently, because the smooth edge of the working portion 19 of the rasp, which extends in downwardly convergent relation with the toothed edge in the upper zone of portion 19, (for example declining along a generally downwardly covering concave path in FIG. 2, to its corresponding portions of the cutting edge) to form a generally wedge shaped zone, bears against the confronting inwardly facing bone surface of the femur shaft and thereby forcefully wedges the cutting edge against the bone surface to be cut away. Also, since only one of the two opposite edges of the rasp is a cutting surface, it cuts in effect with two times the efficiency of a normal rasp having cutting teeth on both surfaces, since the operator does not have to overcome the resistance to cutting offered by the bone portions contacting the smooth edge. Efficiency is also improved because the bone surface against which the smooth edge works assists in forcing the teeth of the cutting edge into cutting engagement with the bone surface portions engaged by the teeth. The two rasp configurations in FIGS. 2 and 4 facilitate reaming the opposite surfaces of the canal as needed by the surgeon.

After forming of the canal in the amputated femur shaft by use of the rasp 15, a jig and femoral prosthesis member or replica are positioned relative to the femur to guide drill bits to form drill holes transversely in the femur for fixation bolts to fix the prosthesis in position. The jig may be of the type disclosed in my co-pending U.S. Pat. application Ser. No. 338,669, entitled METHOD AND JIG FOR TOTAL HIP PROSTHESIS INSTALLATION, filed Mar. 7, 1973, which is used by inserting the replica of the femoral prosthesis shank in the canal, or, a jig of the type disclosed in my earlier U.S. Pat. application Ser. No. 183,418 filed Sept. 24, 1971, may be attached to the femoral prosthesis member, after which the shank of the femoral prosthesis member is inserted in the canal to substantially the proper position. In either case, holes are drilled transversely through the femur shaft by inserting the drill through the guide holes in the guide leg of the jig and through the holes in the replica of the femoral prosthesis shank or through the holes in the prosthesis shank to which the jig is attached, in the manner described in those earlier co-pending patent applications. After the drill holes are formed, and the shank of the femoral prosthesis member is tapped into place and the holes in the prosthesis shank accurately lined up with the holes drilled in the femur shaft, bolts, such as one-fourth inch diameter bolts approximately 2 inches along or 1 3/4 inch long having hexagonal heads, are driven into the proximal cortex and into the deep cortex to fix the femoral prosthesis member. After the femoral prosthesis component has been fixed in the femur, and assuming the prosthesis cup has been fixed in place in the acetabulum, strong traction is applied and, with the aid of a nylon end concave prosthesis inserter, the head of the femoral prosthesis is pushed into the prosthesis cup, tests are conducted to see that the leg has a proper range of movement, and the wound is closed.

The hereinabove described rasp facilitates the formation of an appropriately sized and configured channel corresponding substantially in cross-section and in profile to the stem or shank portion 12 of the femoral prosthesis member 10 in a most efficient manner, providing an accurate fit of the femoral prosthesis member shank 12 in the thus formed canal in the femur shaft. The

femoral prosthesis member can then be accurately and rigidly fixed in the femur shaft, for example by the method disclosed in my earlier U.S. Pat. application Ser. No. 183,418, filed Sept. 24, 1971 or in my later U.S. Pat. application Ser. No. 338,669, entitled METHOD AND JIG FOR TOTAL HIP PROSTHESIS INSTALLATION, with bolts being inserted through the transverse bolt holes formed by the method disclosed in those applications. This makes absolute fixation of the prosthesis member possible without the use of methyl methacrylate cement, as has been frequently used in the past, but which has been discovered to present a serious hazard to the patient, as pointed out in the recent article by Edith R. Kedes, M. D., et al. entitled Inoperative Death Associated With Acrylic Bone Cement, Journal American Medical Association, Volume 222, No. 5, pages 575-577, Oct. 30, 1972. Also, the presence of previous infection in the femur of the patient effectively precludes the use of methyl methacrylate bone cement, whereas use of my fixation technique involving formation of the accurately sized canal for the femoral prosthesis member shank accurately sized by the above-described rasp and fixed in position by transverse bolts allows use of the total hip prosthesis procedure for such patients.

What is claimed is:

1. A femoral shaft surgical rasp for use in performing total and sub-total hip prosthesis surgery to form an elongated canal in an amputated femur shaft for reception of an elongated shank portion of a femoral prosthesis component to be fixed in the canal, the femoral prosthesis having a head portion integral with the shank portion including a flanged neck at the juncture of the head and shank portions and the shank portion having a straight longitudinal edge and a concavely curved opposite longitudinal edge, the rasp comprising an elongated handle portion and an elongated working blade portion extending integrally from the handle portion which is a substantial replica of the prosthesis member shank in lateral profile and cross-section having a pair of opposite longitudinal edges conforming in location and direction to the longitudinal edges of said prosthesis shank defining a wedge-shaped region spaced from a free end of the working portion and the blade portion having flat parallel sides extending between said edges and forming the lateral surface of the rasp blade portion, the rasp having cutting prominences only along the length of a first one of said edges of said working blade portion to confine the cutting action of the rasp on the femur to the internal femur portion in confronting abutment with only said first one of said edges, the longitudinal edge of said blade portion opposite said first one of said edges being smooth throughout its length to slide without cutting on confronting portions of the femur and force more efficient cutting by said first one of said edges due to the bearing pressure of the femur on the smooth edge, and the smooth edge and sides of the working blade portion presenting only smooth, not damaging surfaces to abductors and other soft tissue during reciprocative movement of the rasp in its working path.

2. A femur shaft surgical rasp as defined in claim 1, wherein said elongated handle portion and said working portion extend along parallel axes in opposite directions from the juncture therebetween.

3. A femur shaft surgical rasp as defined in claim 1, wherein said rasp includes a flanged collar formation at

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the juncture of said handle and working portions which substantially duplicates relative to the axis of said working portion the angular disposition of said flanged neck of the prosthesis component relative to the longitudinal axis of the prosthesis shank and presents a flat substantially encircling inclined surface toward the working portion simulating the surface of the flanged neck facing toward the prosthesis shank.

4. A femur shaft surgical rasp as defined in claim 2, wherein said rasp includes a flanged collar formation at the juncture of said handle and working portions which substantially duplicates relative to the axis of said working portion the angular disposition of said flanged neck of the prosthesis component relative to the longitudinal axis of the prosthesis shank and presents a flat substantially encircling inclined surface toward the working portion simulating the surface of the flanged neck facing toward the prosthesis shank.

5. A femur shaft surgical rasp as defined in claim 1, wherein said cutting prominences are located only on said curved longitudinal edge of said working portion of the rasp along the entire length thereof.

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6. A femur shaft surgical rasp as defined in claim 3, wherein said cutting prominences are located only on said curved longitudinal edge of said working portion of the rasp along the entire length thereof.

7. A femur shaft surgical rasp as defined in claim 2, wherein said cutting prominences are located only on said straight longitudinal edge of said working portion of the rasp along the entire length thereof.

8. A femur shaft surgical rasp as defined in claim 4, wherein said cutting prominences are located only on said straight longitudinal edge of said working portion of the rasp along the entire length thereof.

9. A femur shaft surgical rasp as defined in claim 3, wherein said working portion has holes therein identical in size and spacing and location to transverse fastener openings in the prosthesis shank.

10. A femur shaft surgical rasp as defined in claim 6, wherein said working portion has holes therein identical in size and spacing and location to transverse fastener openings in the prosthesis shank.

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