Ann R Coll Surg Engl 1996; 78: 515–520

Current techniques in total knee replacement: results of a national survey

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Key words: Knee surgery; Surgical technique; Prostheses

A postal questionnaire was sent to all Fellows of the British Orthopaedic Association to obtain a census of total knee replacement (TKR) preferences in the United Kingdom; 1162 questionnaires were sent and 721 replies received. There were 92 Fellows who had retired or filled in the forms incorrectly, and 32 no longer perform TKR. Thus, 597 responded correctly, giving a 62% response rate.

This gives an extrapolated total of 34 677 TKRs being implanted per year in the UK, with an average of 34.3 being performed by each surgeon per year. Only 9% perform more than 90 per year.

There were 41 different prostheses in current use among the respondents to our questionnaire, of which five prostheses constituted 61% of the total.

Cemented prostheses were used by 95.2%. Resurfacing of the patella was always carried out by 32%, while 19% never resurface it; the most common reason for doing so being patellofemoral arthropathy at operation.

Intramedullary alignment was used for the femoral component in 86%, 76% preferred extramedullary alignment for the tibial component.

Regarding cementing technique, 43% use pulsatile lavage, 9% used a cement gun, 88% dry the bone and 56% seal the hole made by the femoral alignment device in the femur before cementing. All components were cemented simultaneously by 65% and one at a time by 31%. Metal-backed tibial prostheses are now used by 98% of surgeons, modular tibial components being preferred by 80%. Metal-backed patellar components were used by 13%. An onlay type of patella was preferred by 51%.

This survey highlights the great diversity of surgical practice in the UK, which may reflect uncertainty regarding best practice in total knee replacement.

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A survey into current attitudes to cementing techniques in British hip surgery was conducted by this unit last year *(1)* revealing the wide diversity of use of 'modern' cementing techniques. It also highlighted the range of prostheses in use in the UK today. This year we have performed a similar survey of techniques in total knee replacement. However, although we have once again gathered information about choice of prosthesis and cementing methods, we felt that there were also other important areas where there were wide differences in practice, the scale of which were worth documenting.

Method

A questionnaire was designed using a software package which facilitates analysis of the returns (PinPoint Version 1.0, Longman Logotron, Cambridge, England). It was specifically designed to be restricted to one sheet of paper and for as many answers as possible to be answered with a mark in a box. Free-text or numeric data were kept to a minimum to allow the form to be quick to fill in, and to make the data easier to analyse. We were aware that this unfortunately does restrict answer choice (eg 'sometimes' does not adequately reflect 'usually').

The questionnaire was sent to all 1162 Fellows of the British Orthopaedic Association.

The factors specific to TKR that we were particularly interested in were:

1 The implantation of uncemented components.
2 The use of metal-backed components.
3 The use of modular tibial components.
4 The preferences for intra- or extramedullary alignment devices for tibial and femoral components.
5 The frequency of, and reasons for resurfacing the patella.

Results

We received 721 replies, of which 62 were from retired surgeons, 30 filled in parts of the form incorrectly and 32 no longer performed knee replacement surgery. We were left with 597 replies for analysis. This is a 62% response rate, which was less than last year's survey. The self-selected group of responders do not seem to have particularly eccentric views and we believe that this is a representative group. Among the 597 replies, the average number of TKRs per surgeon was 34.3 per year, with most surgeons performing between 20 and 40 per year (Fig. 1). If this were indeed a representative sample of British orthopaedic practice, the implication would be that 87% perform total knee replacement (1011 surgeons), which represents an extrapolated total of 34 677 TKRs performed in the UK annually.

The percentages shown are for the numbers of surgeons rather than the number of prostheses that they cumulatively implant. The latter figures were comparable as they were on last year's survey.

Of the surgeons, 4.8% use uncemented prostheses (28 surgeons who inserted 610 TKRs—an average of 21.8 each per year, which is less than the overall average of 34.3 per year) and 22% sometimes use one, as shown in Fig. 2.

The 'Top five' prostheses are implanted by 61% of surgeons and constitute 67% of the total number; they are

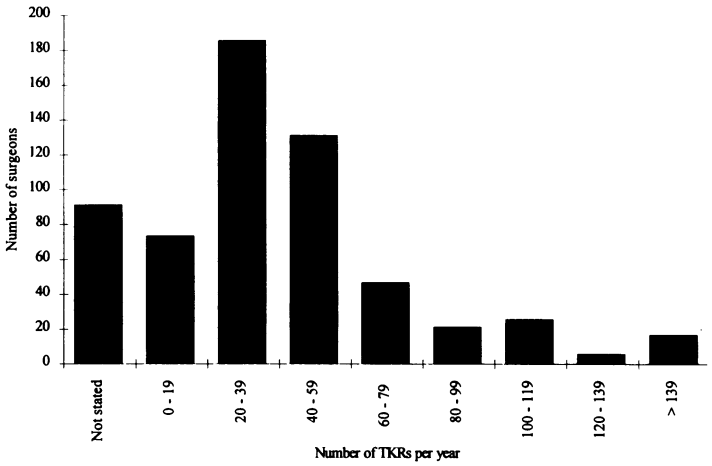

Figure 1. Number of prostheses implanted per year under the name of each surgeon responding.

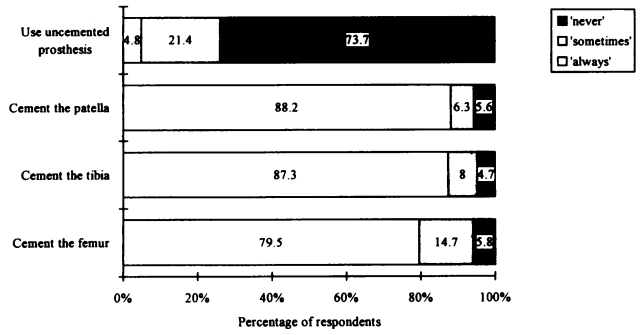

Figure 2. Preferences for cementation of the components.

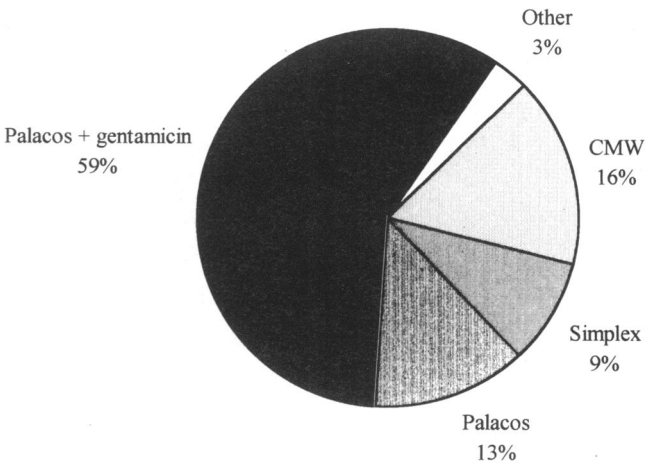

Figure 3. Choice of cement.

therefore implanted by surgeons who perform slightly more TKRs than the surgeons who implant the less popular prostheses.

Of surgeons who perform cemented prostheses, the majority cement the tibial and patellar components, but a considerable proportion (20.5%) always or occasionally do not cement the femoral component (Fig. 2).

Palacos with gentamicin is the most popular cement choice (59%; Fig. 3). Most surgeons (65%) cement all components simultaneously. In Fig. 4, 'other' usually referred to cementation of tibia and femur together and patella separately. There was no consensus on whether the cement should be applied to the prosthesis, the bone or both (Fig. 5).

There was great disparity as to whether the patella should be resurfaced (Fig. 6). The majority stated patellofemoral arthropathy at operation as an indication

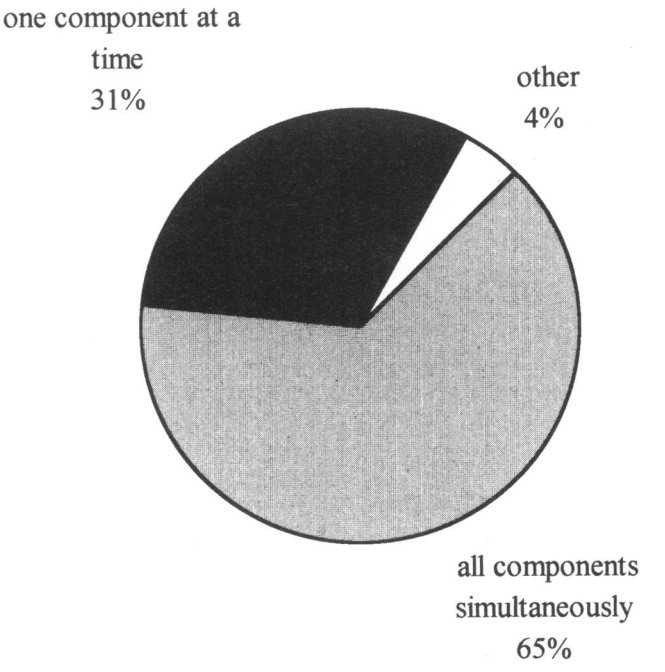

Figure 4. Order of cement application.

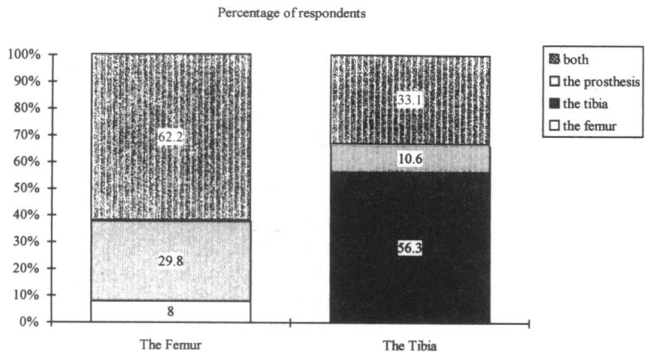

Figure 5. Sites of cement application.

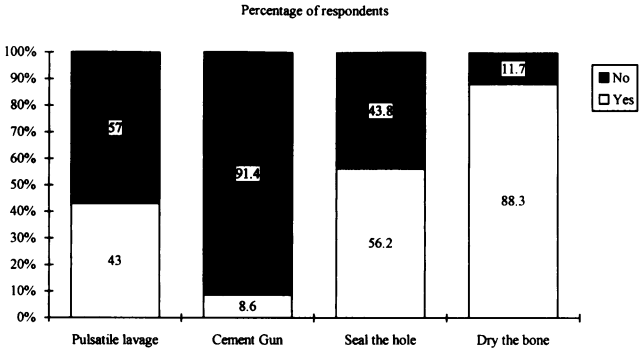

Figure 9. Cementation technique.

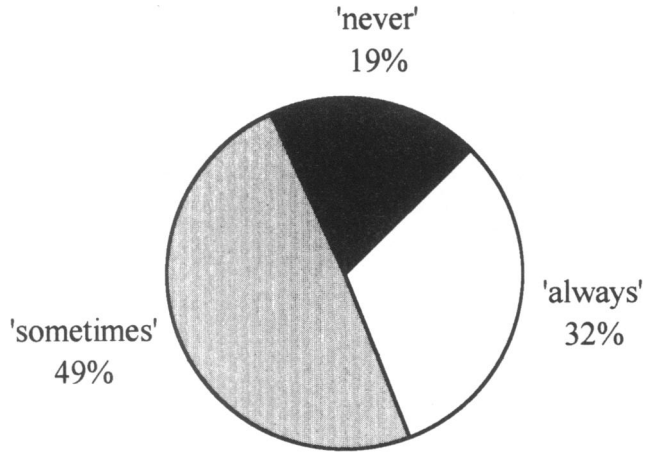

Figure 6. Resurfacing the patella.

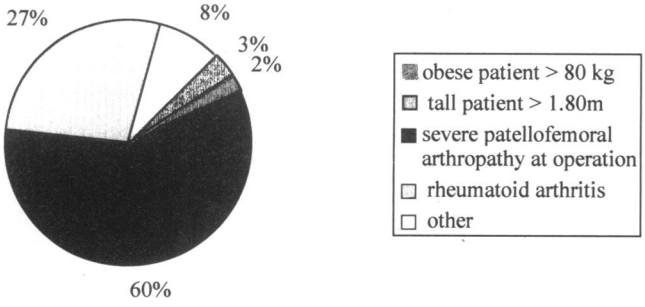

Figure 7. Indications for resurfacing the patella.

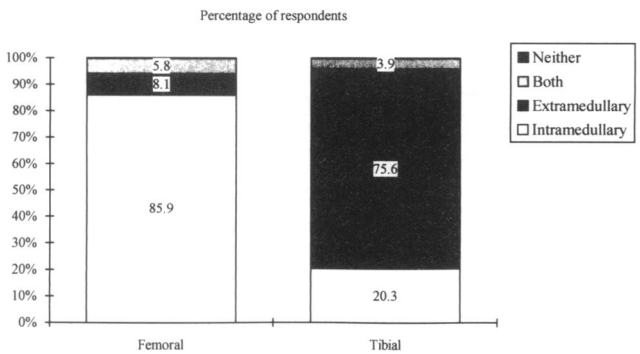

Figure 8. Alignment instrumentation preferences.

to resurface. Many consider rheumatoid arthritis an indication (Fig. 7).

For femoral alignment, 85.9% of respondents use intramedullary methods, whereas for tibial alignment only 20.3% use intramedullary methods (Fig. 8).

Practice of 'modern' cement techniques is shown in Fig. 9; only 43% using pulsed lavage, with 88.3% drying the bone after irrigation. Very few surgeons use a cement gun for TKR (8.6%). The hole created by the intramedullary instrumentation was sealed before cementation by 56.2%.

About one-half (51%) use an onlay type of patellar component, others using an inset type or both types on different occasions (Fig. 10).

Metal backing of the tibial component is now preferred by 98% of surgeons and 80% use a modular implant. Metal backing of the patellar component is uncommon, with 87% preferring an all polyethylene button (Fig. 11).

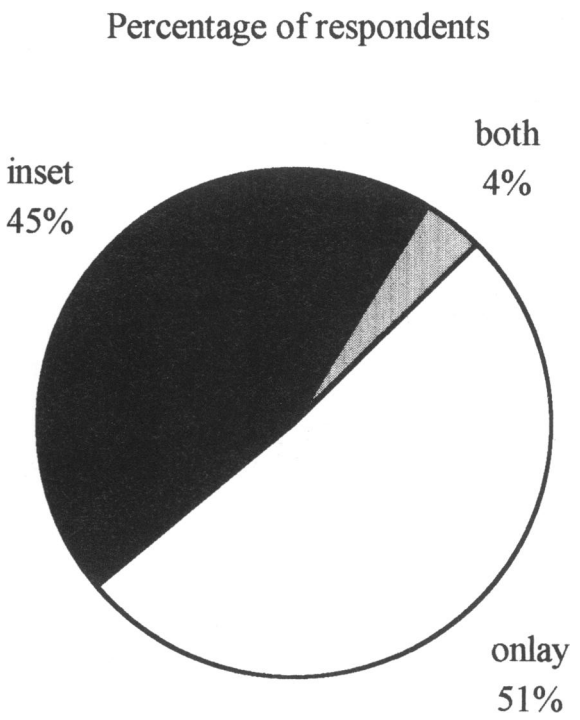

Figure 10. Use of onlay or inset patellar components.

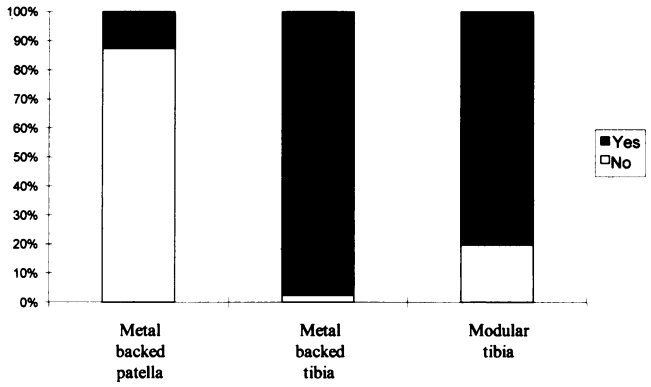

Figure 11. Metal backing of polyethylene components and tibial modularity.

Discussion

If diversity of practice represents uncertainty surrounding best practice, then this survey shows that uncertainty persists in total knee replacement in the UK. Of course, differences may partly be owing to financial constraints. However, assuming surgeons do have the power to choose their preferred prosthesis and instrumentation, the wide range of prostheses being implanted at present in the UK implies that there is no consensus view on the best implant design. There is, however, relative conformity in the majority of condylar implants in current usage. Common patterns are now appearing to emerge for much of the practice of total knee replacement. The following are probably the main outstanding issues to be resolved: whether to cement some or all of the components, posterior cruciate sacrifice or posterior stabilisation, degree of congruence, metal backing and modularity of the tibial component, inlay or onset patellar components and types of alignment instrumentation.

Freeman and Tennant *(2)* and Freeman *et al. (3)* have reviewed the arguments for and against the use of cement and found that there was no good *biological* reason why uncemented prostheses should not be as good as cemented ones and found it hard to justify the use of cement. Clinically, Freeman *et al. (3)* have reported good results with uncemented prostheses for primary TKR, but the prosthesis used in this series was fairly unique in the method of fixation used (plastic with 'fuzzy pegs' for fibrous ingrowth) and these results cannot be extrapolated to other uncemented designs. However, many authors have not found uncemented prostheses to be as satisfactory as cemented prostheses *(4)*. Indeed, Freeman was co-author of a paper which went on to demonstrate that in *clinical* studies the addition of cement to a metal-backed stemmed tibial component improved initial results *(5)* and another which showed that early migration was related to late failure *(6)*. Encouraging results have, however, been achieved with uncemented prostheses for patients with inflammatory arthropathy and compromised bone *(7)* and in revision TKR *(8)*. We will have to wait for the results of the use of hydroxyapatite coated prostheses. Three-quarters of British surgeons, however, remain to be persuaded that cementless fixation is satisfactory. Perhaps this reflects the fact that excellent long-term results of cemented TKRs have now been available for some time *(4,9)*, but follow-up for cementless TKRs are still relatively short (eg 6 years *(3)*).

Several authors *(10–12)* have reported independently that metal backing of the patella carries an increased risk of wear-type implant failure and it has been highlighted that their removal can be difficult *(13)*. Despite a report suggesting that the risk of implant failure can be minimised *(14)* by adjustments to the design and careful attention to implantation technique, most British surgeons remain to be persuaded. Only 13% currently use a metal-backed patella. This is presumably owing to the overwhelming amount of evidence from papers suggesting that satisfactory results are more difficult to achieve with metal backing.

Cemented stemmed metal-backed tibial components have been shown to fail less frequently than cemented all-polyethylene components *(15)* and are now preferred by the vast majority of surgeons; in our survey 97.6% use metal-backed tibial components. Introducing modularity into the tibial component does not reduce inventory size and also introduces another wear interface. The frequency with which simple revision of the tibial polyethylene component is necessary does not seem to justify the risks that this extra interface produces.

The vast majority of surgeons prefer intramedullary alignment instrumentation for the femoral component (85.9%), but extramedullary for the tibial component (75.6%). The former may be because extramedullary femoral alignment can be difficult in obese patients. This is despite the risks that using intramedullary instrumentation may exacerbate the embolic phenomena which have been witnessed sonographically after tourniquet release *(16)*. Extramedullary alignment is easier for the tibial component as the landmarks are more easily palpable. There are also difficulties associated with intramedullary alignment in terms of understanding where the centre of the tibia is projected onto the tibial plateau so that siting of the entry hole can be planned. For these reasons, and in cases of bowed tibia, extramedullary alignment is the method of choice. It is also important to understand that the mechanical axis of the tibia is not the same as the anatomical axis.

Practice and theory of latest cementing techniques (brushing, irrigating, pressurised lavage, cement centrifuging and monomer chilling etc.) were discussed in the paper on hip replacement *(1)* and will not be discussed again. There is now some evidence that 'modern' cementing techniques may reduce the rate of radiolucent line appearance in TKR *(17)*. However, this was a sequential study rather than a parallel one, and may have been influenced by other factors over the time period of the study. Lewold *et al. (18)* and Knutson *et al. (19)* from the Swedish Knee Arthroplasty Register report dramatic sequential reductions in revision rates over a 15-year study period. Improved cementation was postulated as one of several other factors which may have led to this improvement—improved patient selection, learning

curve, improved assistive devices. All of these factors need to be considered when improvements are attributed to new 'improved' designs.

Perhaps the greatest controversy in total knee replacement is whether the patella should be replaced. Apart from problems associated with metal-backed prostheses mentioned above, other problems have been encountered with patellar resurfacing. Lynch *et al. (20)* described quadriceps rupture, patellar tendon rupture, patellar fracture, recurrent subluxation and malrotation, but nevertheless continued to recommend it. Grace and Rand *(21)* have suggested that technique is at fault in the majority of cases and improved results can be obtained with their techniques *(12)*. Marmor *(22)* suggested optimum techniques for patellar resurfacing. He emphasises that the thickness of the patella should be determined with a caliper before removing the articular surface and again after the trial component has been inserted into the patella and these measurements should be the same. Freeman *et al. (23)* implied that lateral retinacular release was responsible for some patellar fractures, postulating that the blood supply may be jeopardised by this manoeuvre.

We have showed that 32% of British surgeons currently believe that the patella should always be replaced and 19% that it should never be replaced. The remaining 49% indicated how they decide whether to replace the patella or not (Fig. 7), with many making the decision at operation depending on the degree of patellofemoral arthropathy present. Other factors were height, obesity, rheumatoid arthritis and patellofemoral symptoms before operation. A report of a well-controlled prospective study of 52 patients who underwent bilateral TKRs—with patellar resurfacing on one side but not on the other—was published after our questionnaires had been returned *(24)*. This showed that, at equal average follow-up of just over 5 years, there were no significant differences in any of their outcome measures. Unfortunately, the paper does not state that the decision to replace one side in preference to the other side was made at random and implies that some subjective assessment still needs to be made. The question of whether to resurface the patella or not will therefore remain a matter for debate.

Conclusions

We conclude that in the UK current practice in total knee replacement usually consists of:

1 Cementation of the tibial and femoral components. This includes pulsed lavage for only just over one-half of the respondents. Cement guns in TKR are not commonly used.
2 Use of metal-backed tibial component.
3 Use of intramedullary alignment for the femur.
4 Use of extramedullary alignment for the tibia.
5 Use of a modular tibia.
6 Use of an all-polyethylene patellar button if one is implanted at all.

There was no consensus on whether or when patellar resurfacing should be carried out. Many surgeons were unaware of the relative merits of onlay or inset patellar components.

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Received 20 December 1995