



Editorial

The UK Knee Osteotomy Registry (UKKOR)



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Registries

The orthopaedic data revolution is underway with a requirement for all orthopaedic surgeons to define the data collection culture [1]. A vehicle in this revolution are the newly emerging surgical registries, created to provide high quality, patient centred, outcome data which will be required to inform service commissioners [2].

Knee osteotomy is undergoing a separate revolution [3,4] with a resurgence of interest from surgeons looking to offer a disease modifying option for younger patients. Angular stable fixation devices now provide improved initial stability which has facilitated the increasing use of the tibial medial opening wedge [5]. Opening wedges are easier to control during the procedure offering increased surgical confidence in the achieved correction [6]. Younger patients occupy a treatment gap [7] when arthritis is graded I to III [8], because unicompartmental arthroplasty is contraindicated without bone on bone contact. These patients are often told to wait until they are candidates for arthroplasty without receiving symptomatic relief. A well performed knee osteotomy can delay disease progression and treat unicompartmental arthritis with pain relief and durable restoration of function [9]. However, when compared to unicompartmental and total knee arthroplasty, osteotomy has been criticised for exposure to the risks of failure and revision surgery [10]. However this reproval fails to observe the greater functional benefit from retaining native knee kinematics and ignores that primary arthroplasties are also threatened by revision. As surgical techniques for osteotomy have evolved the previous long term follow-up studies now analyse the results of already outdated procedures [11]. Emerging papers using modern osteotomy techniques report encouraging survivorship [12]. There is clearly a requirement to provide robust evidence of patient outcomes [13] using modern techniques, as justification for knee osteotomy against surgical alternatives.

The UK Knee Osteotomy Registry (UKKOR) has been established to provide this evidence. Clinical registries use observational study methods from a broad population base and so their findings have strong external validity [14]. The larger sample size from a registry database allows analysis of the multiple variables which can influence outcome [15]. Individual patients vary greatly in their presenting deformities and surgical techniques also vary, so UKKOR is not a registry attempting to identify outlying surgeons. Instead our focus is directed to improving the quality of patient care by monitoring outcomes. Whilst it will take

several years to amass sufficient data, our specific goals at the outset include:

1. Define patient selection criteria with greater clarity.
2. Identify the devices and surgical techniques which give the best results.
3. Use stratified outcome data to influence the choice of intended alignment correction.

In 2005 the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS) defined the indication criteria for high tibial osteotomy (HTO) [16] as young, thin patients with metaphyseal varus and medial joint line pain. These criteria have been extended such that osteotomies are now being performed on patients younger than 40, older than 60 and in obese individuals [3]. Osteotomy can be combined with ligament reconstruction [17], joint preserving procedures such as microfracture [18] and meniscal transplantation [19,20]. Osteotomy has been employed to treat focal chondral deficiency [21] such as recalcitrant osteochondritis dissecans and may have a role in patellofemoral instability [22]. Osteotomy can have beneficial effects on distant joints [23] or in treating painless effusions [24]. Registry outcome data will confirm or refute the list above as valid indications for HTO and clarify selection criteria. In contrast the indications for distal femoral osteotomy (DFO) have never been formally defined [25]. UKKOR has been designed to collect outcomes on both HTO and DFO as well as the rare occasions when double osteotomies are performed.

The best results will be judged by good outcome scores and high levels of reported activity. Different devices and techniques will be subject to regression analysis to identify successful practice. In addition, a prospective collection of complications (perceived by both patient as well as surgeon) offers transparency which should enlighten the consent process and improve patient understanding. Going forward it will reduce risk to the 'herd' by assimilation and adoption of best practice. In essence UKKOR will provide information for the benefit of both patient and surgeon.

In 1979 Fujisawa [26] published his thesis upon 54 knees where osteotomy results were studied arthroscopically. His conclusion stated that the ideal correction aligns the mechanical axis through a point 30 to 40% lateral to the midpoint. Without detracting from his work, which has historical significance, we find the literature littered with books and articles where these potentially ambiguous figures have been misquoted. If each side of the plateau represents a half, then 30–40% of the lateral plateau is equivalent to 15–20% of the whole. When the medial plateau is added (as 50%), then Fujisawa's point is 65–70%. Thus the correct figure of 67.5% is distinct from the 62.5% target which has erroneously propagated from one piece of work to the next [4,11, 27–29]. Perhaps it is a small mercy that this misinterpretation erred

towards neutral because many surgeons would consider 67.5% an aggressive correction. Most would agree that the correction should be aimed just beyond the tibial midline, but opinion is divided concerning how far beyond. Some surgeons aim for neutral, others match alignment to the healthy contralateral leg, some observe the degree of medial arthritis [30], and others consider the difference between compartments [31]. A bespoke correction for individual patients considering the degree of arthritis and some of the indications listed above has recently been proposed [32]. The reliability of planning methods has been quantified [33,34] but work on how this converts into surgical accuracy is ongoing. The registry will explore how the achieved correction influences outcome, in essence an old question is being modernised with validated patient centred outcomes. These findings may go on to influence the choice of intended correction.

We estimate that a thousand knee osteotomies are performed annually in the UK. These figures are based upon sales information obtained from the company holding the majority share for osteotomy fixation devices in the UK. The same information was used to invite targeted surgeons to an online survey (www.surveymonkey.com/s/8CHBNJ8). This survey remains open and we would welcome further responses from surgeons yet to participate. We are grateful to the 62 respondents for providing us with an early indication of current UK practice. Subsequently we have a rough idea of volume for individual surgeons but we do not yet know if this translates into a better outcome. We enquired about age and found that 43% of respondents consider the ideal age to be less than 50 and only 28% would consider performing osteotomies on patients older than 65. Planning for each case by analysing individual deformity is the established wisdom and 71% of surgeons annotate this plan on long leg radiographs, 22% use digital software and 7% use short knee xrays. The most commonly employed procedures are the tibial medial opening wedge for varus cases and the femoral medial closing wedge for valgus cases. We were encouraged when 92% of respondents stated that they would participate in a national osteotomy registry.

We are indebted to the example shown by our forerunner the National Ligament Registry (NLR) [35]. UKKOR has unashamedly chosen to follow the same model employed by the NLR committee. Thus the Amplitude data platform (hosted by Bluespier) has been selected. The software platform and the behavioural changes required to collect this data should now be familiar to knee surgeons who contribute to the NLR. UKKOR has been established by surgeons, independent of government agencies. To achieve this we have required external funding, received gratefully as sponsorship from five companies with a stake in osteotomy surgery. Sponsoring companies will have access to performance data on their own products but not their competitors. In addition BASK have been supportive of the project and provided a generous priming grant.

The inclusion of patient reported outcome measures is vital to increase any registries' sensitivity to define success [36]. The outcome measures chosen include the oxford knee score (OKS) [37], the knee injury and osteoarthritis outcome score (KOOS) [38], EuroQol (EQ5D) [39,40] and the recently validated activity participation questionnaire (OKS-APQ) from the Oxford group [41]. Patient co-morbidities will be quantified with the self administered co-morbidity questionnaire [42]. We hope that patients will be persuaded to participate because they can see their charted progress after surgery. In this day and age patients often migrate between dwellings but they tend to keep an email address and mobile phone number, so these pieces of information are thus critical to facilitate automated patient follow-up. We see this as a distinct advantage over the staffing requirement and financial burden of paper based registries.

We appeal to all osteotomy surgeons to offer their support and engage with this registry by contributing both patients and data. Prior to the official launch (November 2014) we have several surgeons registered who may be classed as 'early adopters'. We envisage that this number will increase with recognition of the registry as a useful

governance instrument providing information for appraisal and revalidation. However, future compliance from both patients and surgeons is a potential concern. We have attempted to mitigate this by creating a visually appealing website which is informative and engaging with the inclusion of video explanations: www.ukkor.co.uk The website has been visited 500 times in its first month. If further incentives are needed then the steering committee has agreed that all future publications drawing conclusions from UKKOR data will be authored by the "UKKOR research collaborative." Thus all surgeons who contribute patients and data will be listed as contributing authors on future PubMed citable manuscripts. We recognise that there is a collective philosophy amongst the knee surgeons who employ osteotomy. We want to harness this shared attitude to collaborate in answering some of these questions as soon as we can.

Conflict of interest statement

Commercial sponsorship has been solicited in order to provide the necessary funding to establish this registry. The steering group has deliberately approached several industry stakeholders in order to maintain a neutral bias towards any one company or commercial party related directly or indirectly to the subject of this article.

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