

## The rapid evolution of knee osteotomies

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For many years, osteotomies were ranked among the most important surgical procedures in the treatment of unicompartmental osteoarthritis of the knee. Following the success of knee arthroplasty, they have lost a major part of their initial impact. Recent data from the national knee arthroplasty register in Sweden have shown that the preferred treatment for young osteoarthritic patients is total knee arthroplasty [10]. The rate of osteotomies in this population has declined rapidly over the last decade, and the authors of this study pointed out that there is a real risk to see this treatment alternative eventually abandoned by surgeons.

In several other European countries, an increasing interest in osteotomies has been noted over the past decade [3–6, 8, 9]. This revival started with the development of new osteotomy techniques and fixation methods. Modern osteotomy concepts include precise planning, safe and

reproducible surgical techniques and a high primary stability of the implants used for fixation. They are supposed to induce few changes in the bony anatomy and do not bear the need of supplemental procedures such as fibular osteotomies. In standard conditions, their complication rates are nowadays below the acceptable 5 % range in low-volume as well as in high-volume surgeons. Patients have a good early outcome and some can even resume sports activities.

Indications have evolved as well. In the early times, osteotomies were mainly limited to patients with grade 4 osteoarthritis. In the middle of the past decade, ISAKOS summarized the inclusion criteria as well as contraindications of osteotomies [7]. Now we see these criteria evolve in the hands of the most experienced surgeons. Osteotomies are increasingly performed in patients under the age of 40, and increasing experience is gained in overweight patients. They are progressively used on a routine basis either as a stand-alone or a combined surgical option in patients with early osteoarthritis or compartment overload, in patients with knee instabilities or as an additive procedure in patients where a biological reconstructive procedure, for example, cartilage surgery and meniscus transplantation, is considered.

Indications, operative technique, fixation methods and results of the currently available techniques are different from those of the initial methods. In general, new surgical procedures have to undergo four different phases until they will be globally accepted. In the initial *pioneering phase*, the procedure is developed and the initial investigators' early results are presented. In the *standardization phase*, the technique is used successfully by other surgeons and it is simultaneously refined in the developers' hands. General strategies are developed to prevent and manage the remaining complications. In the *phase of outcome*

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*assessment and evidence acquisition*, the initial results must be confirmed in the mid-term or even long term. In the final *phase of general acceptance*, the results can be transferred to a global scale. In orthopaedic surgery, many techniques do not go beyond phase 2 because either the initial theoretical concepts cannot be confirmed in all hands or initial animal experiments cannot be reproduced in patients. As such, we can confirm that in 2012 the new osteotomy concepts survived the storm of their early development phase. They became very popular in many European countries. Nowadays, they can be considered to be between the second and the third phase, depending on the surgeon's individual experience and his geographical location.

However, to get to the last level, there is still some work to do. The American Academy of Orthopaedic Surgeons recently developed a full guideline for the (non-arthroplasty) treatment for osteoarthritis of the knee [1]. The workgroup came to the conclusion that realignment osteotomy is an option in active patients with symptomatic unicompartmental osteoarthritis of the knee with malalignment. The qualification 'is an option' was only the third level (C) of recommendation after 'we recommend' (A) and 'we suggest' (B). The level of evidence on which the AAOS workgroup made its decision was as low as Level IV and V, meaning that there is only poor quality evidence for or against recommending the intervention. The best they could get out of the current literature was that the Level IV case series evidence suggested that realignment osteotomy had benefits that lasted up to 2 years after surgery. They did not analyse longer-term results because of loss of patients in the relevant studies. This lack of evidence is also reflected by A. Amis' manuscript [2] summarizes the biomechanics of high tibial osteotomy where he states that many of the clinically accepted rules for osteotomy planning and surgery have been based on experience, rather than having been optimized via scientific methods.

This shows that there is still a lot of research to be done to achieve the final goal of global acceptance. By editing 28 new manuscripts in this unique issue originating from authors from 12 different countries (Japan, South Korea, Canada, Denmark, United Kingdom, Netherlands, Belgium, Luxembourg, Germany, France, Switzerland and Italy) and three continents, we managed to show the global interest in this surgical procedure. The majority of papers ( $n = 11$ ) deal with clinical outcome, eight manuscripts are

on technical and surgical issues, eight are dealing with experimental questions, one is on computerized preoperative planning, and one is on specific complication management. We are convinced that the current KSSTA issue, which is solely dedicated to this subject, will help to bring further evidence to osteotomy. Considering its rapid evolution, the limited survival of knee arthroplasty and our patients' increasing life expectation, we feel that the commitment to arthroplasty should be postponed as long as possible. Osteotomy should be considered systematically in the treatment algorithm of every single patient who is less than 60–65 years old presenting with unicompartmental overload or osteoarthritis as well as in patients selected for biological reconstructive procedures and those presenting with complex knee instabilities.

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