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Kaizen and the 'accumulation of marginal gains'

Sometimes new concepts and ideas can come from the most unexpected of quarters. Ad Gandhe (Portsmouth Queen Alexandra) started his argument in a debate on distal radius fractures with the concept of Kaizen. A word which may sound to you like it did to me, surprisingly familiar, having been brought into the English subconscious by David Brailsford, the TeamGB cycling coach. I was slightly surprised it had found its way onto an AO Advances course – but Ad gave some surprisingly good arguments as to why it is essential in surgery. The Japanese concept is that of 'accumulation of margin gain'. The British Cycling Team used it with resounding success, as have Team Sky in the recent Tours. The concept is that whilst a small individual variable may make no difference to the overall outcome (say the material of a jersey, or the shape of a bolt head), all added together, the difference may be significant. This of course was proven to a great effect in the London Olympics where Team GB cyclists swept the board.

This concept explains the orthopaedic mindset. Surgery is, by its very nature, a concert of minor steps and decisions, all contributing towards the end result. No individual surgical step, screw length or trunion taper dimension determines the overall outcome, but all contribute. So, as surgeons we are taught to strive towards 'accumulation of marginal gains'. And it works. We know that with practice, outcomes improve. Recent papers featured in 360 have established that 30 hip re-

placements a year are required to be any good at them, freehand distal locking is easier with practice and that surgical simulation improves surgical outcome. QED, one might think.

The Kaizen principle (which is actually a quality management technique popularised by Toyota) seeks to break a complex problem into its simplest steps, then refine each one, thereby improving the whole process. It is at odds with the Pareto principle (which states that 80% of improvement comes from 20% of changes) and has been prevalent in business and healthcare models for many years. The Kaizen principle has been used in arthroplasty and implant design successfully. Having established the basic designs that work (perhaps 'maxed out' on the Pareto principle if you like), implant companies and surgeon designers have sat down and undertaken series of iterative small changes to accumulate these marginal gains. The difficulty is of course that the effect size of a functioning total hip for example is so large the marginal gains are lost (or form just a small part of the whole). The other issue with this technique is it stifles innovation.

The defining outcomes in any study can be many things, but they are often dominated by the poor outcomes. The causes of poor outcomes have changed as surgery conducts its own Kaizen process. Aseptic loosening is a rarer cause of failure than it was – often dislocation or peri-prosthetic fracture now predominate. The same is true in fracture fixation, where nonunion is becoming less common, although infection is still a problem. Having all

but solved some of these problems (longevity in THA for example), further marginal gains look ever more 'marginal'.

I was hugely encouraged to read two papers featured in the Research section this month^{[[1,2]]} both talking about smart coatings aimed at reducing peri-prosthetic infection rates. A synergy of tribology and basic science with clinical application, and one that perhaps relies less on the Kaizen principle and more on innovation. Both processes have their place in orthopaedics, but if we are to continue to push the frontiers of orthopaedic science and surgery we must both innovate and refine. Pushing forwards the boundaries of what is possible in patient care can no longer be achieved through either Kaizen or Pareto principles alone, but a combination of both. A firm understanding of what's happening in the research world will stimulate both.

Finally, I would like to commend Bone & Joint Research to all practicing orthopaedic surgeons; under Prof Hamish Simpson's new editorship I am sure it will build on the firm foundations set out by Prof Andrew Carr.

REFERENCES

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2. Neut D, Dijkstra RJ, Thompson J, et al. TA biodegradable gentamicin-hydroxyapatite-coating for infection prophylaxis in cementless hip prostheses. *Eur Cell Mater* 2015;29:42-55; discussion 55-56.