

# The 8 Essential Steps to Achieving A Kick Like Beckham

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By Prof Lee Eng Hin & Dr James Hui

## STEM CELLS TO TREAT WEAR AND TEAR

Stem cell biology is an emerging area of research that holds infinite promise but is filled with controversy. Stem cells have the potential for self-renewal (give rise to more stem cells) and differentiation (give rise to different types of tissue).

Many studies have been carried out with mesenchymal stem cells (MSCs) in musculoskeletal tissue engineering applications. These include direct transfer of MSCs into physal growth defects, cartilage defects such as in osteochondritis dissecans and augmentation of ligament reconstruction. MSCs have also been used successfully in osteogenesis Imperfecta. MSCs with modified genomes can also be used to treat certain genetic disorders.

Recent animal studies from our and other institutions have shown evidence for the tremendous potential of mesenchymal stem cells (MSCs) in biological resurfacing of cartilage defects. These MSCs can be transplanted either as a cell suspension (injected underneath a periosteal patch) or within its own matrix or scaffold. These cells have the potential to form cartilage and bone; and have, in fact, been cultured in vitro and induced to form cartilage prior to implantation into chondral defects in rabbits. Macroscopic evaluations have indicated that full chondral defects in goats that were treated with autologous implants derived from bone marrow were all filled with hyaline-like tissue.

One of the most established clinical applications of the use of MSCs is in the repair and regeneration of cartilage defects. Cartilage has very poor healing capacity and rarely heals spontaneously. Full thickness chondral injury to trauma can lead to degenerative changes in the articular cartilage. Improved understanding of cartilage biology, coupled with the use of advanced imaging techniques and arthroscopic surgery, have led to more aggressive approaches to managing lesions due to articular cartilage damage.

Our institution has begun autologous chondrocyte implantation for knee injuries from 1999 with a prospective cohort evaluation in an NMRC-funded and IRB-approved clinical trial. We have treated 39 patients, aged 13 years to 53 years, to date. 32 patients have had greater than 12 months follow-up. Overall, 92% of our patients have improved symptomatically. In our 7 patients who volunteered for a second-look arthroscopy at one year post-operation, good repair tissue with integration with

## THE 8 ESSENTIAL STEPS

1. Sustain a knee cartilage defect. Don't worry, this is not as difficult as it sounds. It can be easily achieved by injuring your knee. (You get to choose how you want to do it, e.g. soccer.)
2. Aggravate your knee injury so as to initiate degenerative changes in your knee cartilage and diminish your quality of life. Try weightlifting on rollerblades in an ice skating rink for starters.
3. Approach an Orthopedic Surgeon in an institution that has a program of autologous chondrocyte implantation funded by NMRC and approved by IRB.
4. Allow them to do an MRI and arthroscopy to see how well you have done for steps (1) and (2). If you have been conscientious, you will then pass this test and be allowed to go on to step (5).
5. Next, they will harvest a small piece of cartilage from a non weight-bearing part of your knee. They will dissect, digest and culture this for three to four weeks, and then transplant it back to your knee. (For those of you who are getting lost, this is just a long-winded way of saying that they will cut and paste your knee cartilage.)
6. Try to contend with Continuous Passive Motion for three days and non weight-bearing activities for six weeks.
7. If you are in a good mood, let them do an arthroscopy again one year later just to satisfy themselves that there has been no foul-up.
8. Look forward to a renewed life with great knee cartilage and a great kick like Beckham!

surrounding host cartilage was observed. There was no adverse reaction related to surgery and no case of infection reported. Since, 2002, the Ministry of Health has funded the above programme under its Hospital Service Development Plan (HSDP) in which patients enjoy a great subsidy.

## NO BONES ABOUT IT

The potential for stem cell repair of damaged cartilage and bone will provide hope for a better functional recovery, be it a soccer superstar or a young child following traumatic injuries. Let us hope that the breathtaking pace of stem cell science can really "bend it like Beckham" and score big goals for the future of clinical orthopaedic medicine. ■