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Editorial

The journey of articular cartilage repair

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The terminology of "cartilage" derives from a Latin word "cartilago", and in Greek it means "chondros." The recognition of cartilage as a vital tissue of the body has been there for ages. Aristotle was the first scientist to mention it vaguely in the fourth century BC.[1] In a famous quote the renowned anatomy surgeon, John Hunter (1743) stated: "Cartilage injury is a troublesome thing and once injured is seldom repaired." Unfortunately, this remained a general assumption of thinking about cartilage repair for the next 200 years! Since the 1980s, there has been a sudden interest and flurry of cartilage research. Several concepts developed during this period laid the foundation for technologies in current use today.[2]

In a recent internet search, the word "cartilage" produced a whopping 1,88,00,000 results on Google search engine and 1,08,804 published articles in Pubmed. So far 4827 research article, reviews, and case reports have already been cited in Index Medicus; out of which, 1654 have been only in the last 5 years, indicating a recent surge in the interest of cartilage repair techniques. Awareness about the cartilage physiology, anatomy, and repair techniques has risen significantly in the recent past. The International Cartilage Repair Society (ICRS) was founded in 1997 in Switzerland and after 18 years of its formation it has now 1300 members from 66 countries. Similarly, many other such organizations have been recently formed all over the world by the scientists and surgeons interested in the cartilage. Indian Cartilage Society (ICS) was founded in 2005 and has already 150 active life members.

Injuries to the articular cartilage have been recognized as a cause of significant morbidity since the period of Hippocrates in ancient Greece and affect approximately 1 million patients each year within the United States, alone. Cartilage defects have a tendency to progress and resulting in symptomatic Osteoarthritis (OA) and ultimately resulting in the requirement of a joint replacement. Hence, interventions aimed at repairing and restoring the cartilage are needed,[3] especially in younger individuals. Various attempts to repair the cartilage had been tried historically such as blood-letting, Roman baths, Shark cartilage, various herbs consumption and acupuncture. Many techniques are now being used for cartilage repair including abrasion, drilling, micro fracture (MFx), autologous osteochondral transplantation (OATS), allografts and autologous chondrocyte implantation or ACI (using a variety of new techniques) either as two-staged or a single-staged procedure. The pioneering work of Priddie on subchondral drilling (1959), Lanny Johnson on abrasion arthroplasty (1986), Matts Brittberg for autologous chondrocyte transplantation (1994), Steadman for micro fracture (1997) and Hangody for OATS (2001) can be considered as landmark contributions toward the development of current repair techniques of articular cartilage.[4–8] In less than three decades of its development and clinical use, ACI has already seen significant changes from the use of periosteum flap (1st generation) to the use of biological scaffolds with a variety of cells (chondrocytes, mesenchymal cells (MSCs), etc.) as the 4th generation of ACI. The two stage procedures of ACI are now giving way to single stage arthroscopic techniques of cartilage transplantation[9] and these procedures seem attractive to both the patients and the surgeons.

Operative strategies can be grouped into palliative, reparative, and restorative techniques. Individuals with low physical demands and smaller lesions are considered for palliative procedures such as arthroscopic debridement and lavage, whereas young patients with high physical demand are considered for a reparative or a restorative treatment. The reparative techniques consist of marrow stimulation (e.g., drilling, MFx, etc.) that result in the formation of fibro cartilage, whereas restorative methods (e.g., OATS, Allograft, ACI, etc.) aim to replace damaged cartilage and are indicated for large symptomatic lesions or prior failed treatment, in high demand individuals.

Tissue engineering techniques are likely to become the basis for the next generation of cartilage regeneration technology. These approaches use a variety of cell sources, including autologous, allogeneic, xenogeneic and stem cells. Although a 'gold standard' cell source has yet to be identified, stem cells stand out regarding their availability and minimization or lack of donor morbidity. Furthermore, the combination of tissue engineering with both biochemical and exogenous biomechanical stimulation has resulted in repair tissues with even better hyaline-like properties. Tissue-engineered, cell-free scaffolds, as well as cell-based,

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scaffold-free approaches offer even further hope for the treatment of cartilage repair. These techniques would aim to produce biomimetic tissues that recapitulate the biological, structural and functional features of native cartilage.[10]

The knowledge of cartilage repair is continuing to expand at a rapid rate. However, it is accepted clinically that only symptomatic cartilage lesions should be treated surgically. There is also a general agreement that any mal alignment of the joint, if present, must be corrected before cartilage restoration treatment. The treatment algorithm must be reassessed continuously. The cartilage lesion with an appropriate scaffold and growth factor would be available for transfer directly to articular cartilage defects. It is important for Orthopaedic surgeons to be aware of the new research in the field of cartilage repair so that they can provide the best and most cost effective treatment for their patients. Hence, this particular issue of "Chondros" is a positive and significant step in creating awareness and spreading useful knowledge to the Orthopaedic community of India and elsewhere. All the invited and research articles in this issue have done justice to the theme of this special issue "restore the cartilage and save a joint" and have brought out the latest scientific information about the various current techniques in the field of cartilage restoration and regeneration. I strongly feel that 'Regenerative Medicine' will win over 'Reconstructive Medicine' in times to come.

Due to increasing knowledge and promising results, cartilage repair treatment is now moving out of the realm of super specialists to the more widespread Orthopaedic community. Beware, both the doctors and the patients are now looking out for the so-called 'biologic treatment' option for joint injury and disease! However, there are still some barriers to the routine use of these useful cartilage restoration techniques due to lack of clear guidelines and understanding of the administrators, insurance companies, and governmental approving authorities.

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Issue Editor
Raju Vaishya MS Orth, MCh Orth Liverpool, FRCS England [a,b,*]
[a]*Sr Consultant Orthopaedic & Joint Replacement Surgeon, Indraprastha Apollo Hospitals, New Delhi, India*
[b]*President Elect, Indian Cartilage Society, India*

[*]Correspondence to: Sr Consultant Orthopaedic & Joint Replacement Surgeon, Indraprastha Apollo Hospitals, New Delhi, India
E-mail address: raju.vaishya@gmail.com (R. Vaishya).

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