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Karin Büttner-Janz

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An Artificial Disc and the Start of a New Era in Spine Treatment

KARIN BÜTTNER-JANZ, MD, MBA[1,2]

[1]*Charité – Universitätsmedizin Berlin, Berlin, Germany;* [2]*Büttner-Janz Spinefoundation, Berlin, Germany*

FIRST ARTIFICIAL DISC

With the Charité Artificial Disc (CAD), a new era of degenerative disc disease treatment began as an alternative to fusion. In 1984, the first patent of the CAD was filed, and the first patient was operated on with the model I of this artificial disc, giving birth to a new strategy for the surgical treatment of the spine worldwide. The CAD was developed in the Charité – Universitätsmedizin Berlin (Germany) by Prof. Dr. Kurt Schellnack (1932–2023) and me based on our experience with artificial joints of the hip and knee. In model III of the CAD, the two prosthesis components for anchoring to the adjacent lumbar vertebral bodies were made of a CrCoMo alloy and the sliding core moving between them was made of ultra-high molecular weight polyethylene. As head physician at an orthopedic clinic in the 1990s, I was the only one in Germany to implant the CAD for a longer period of time. The Hamburg (Germany) CAD production company worked with me to further develop the CAD up to 2001, for example, on the prosthesis sizes, angles, and bioactive coating of the prosthesis plates. Despite resistance from various sources, the CAD made its way throughout the world. In 2003, the ownership of the CAD changed from a company in Germany to a company in the USA. Surgeons were quickly trained to implant the CAD, ensuring that the expected scope could be achieved. The learning curve, from the indication for surgery to the surgical technique and the selection of the prosthesis components, was paralleled by high expectations of restoring health. In 2004, the CAD became the world's first artificial disc to be approved by the US Food and Drug Administration. The CAD was later further developed into the InMotion disc, but this prosthesis was then taken off the market because the US company purchased another company with a different disc prosthesis.

LESSONS LEARNED

What could be learned from the application of CAD and other motion-preserving implants for disc replacement over the years? A so-called damping function of an artificial disc can be neglected, especially since the pressure of a healthy intervertebral disc is very high in order to permanently maintain the intervertebral distance. Segmental instability, for example, due to lytic spondylolisthesis, is a contraindication for artificial discs. Segmental kyphosis is also not indicated for an artificial disc because of the danger of postoperative recurrence of kyphosis—or the implant itself prevents hyperkyphosis. Degenerated facet joints can cause pain postoperatively, even though they are anatomically reconstructed as a result of prosthesis implantation. The implants must cover sufficiently large areas on the vertebral body endplates so that the implants do not subside. The primary anchoring of the prosthesis plates must be extremely stable so that there is no micromotion to the vertebral bodies, which can lead to bone necrosis with the risk of a reduction in the height of the vertebral bodies and a resulting migration of the prosthesis. The prosthesis components that move relative to one another must be made of material that can be expected to provide long-term stability and therefore has as little abrasion as possible. The function of an artificial disc should result from 2 planes of motion in order to come as close as possible to the instantaneous center of rotation of a natural disc. To protect the facet joints, the extent of motion in all directions should correspond to physiological conditions. In order to prevent heterotopic ossification, the postoperative application of appropriate medication should be considered. The comparison of results between artificial discs and fusion surgeries should only be made if sufficient motion in the intervertebral space is proved in all disc prostheses included in the study. This also applies to studies with regard to adjacent segment degeneration and disease.

SPINE ARTHOPLASTY SOCIETY—INTERNATIONAL SOCIETY FOR THE ADVANCEMENT OF SPINE SURGERY

A quarter of a century ago, motion-preserving spinal implants and everyone involved found their home in the

Spine Arthoplasty Society (SAS). Just as the society was later renamed the International Society for the Advancement of Spine Surgery (ISASS), it continued to develop as a society that was always open to innovations. The 25th anniversary can now be celebrated with pride. My colleagues and many others contributed to the founding of SAS/ISASS, further developing, and maintaining this special society because the surgical focus was always on maintaining motion and good function of the spine. As the author of this article, I look back with great pleasure and gratitude on the years I served on the society's Board of Directors, beginning in 2003. During this time, I was involved as local host of the 2007 Spine Arthoplasty Society annual meeting in Berlin, Germany, and as president of the society responsible for the 2008 annual meeting in Miami Beach, FL, USA. As membership chair, I conducted conferences with spine surgeons in China, India, and the Middle East. During my presidency of the society, together with other directors of the board, the Bylaws were written in accordance with the development of the society, approved by the Board of Directors and society members as the first set of rules. The work of the society was defined, the renaming of the society was prepared, and the new logo was created. It was a great time, characterized by interesting annual meetings and other scientific and educational events, with the irrepressible will to maintain and further develop the society as the home for spinal implants and surgeries, for motion preservation and innovation, for everyone involved.

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Corresponding Author: Karin Büttner-Janz, Charité – Universitätsmedizin Berlin, Charitéplatz 1, 10117 Berlin, Germany; buettner-janz@spinefoundation.info