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## Arthroplasty of the spine: the long quest for mobility

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Joint replacement is a logical step in the treatment of severe joint pathologies with irreversible lesions resisting conservative therapy. While hip arthrodesis brought relief to many patients, total replacement opened a new era in orthopedics and revolutionized the quality of life for coxarthrosis sufferers. These pioneering efforts were soon followed by similar techniques being proposed for other peripheral joints, sometimes with only qualified success. Knee replacement is now routine surgery, whereas shoulder arthroplasty is less common, while ankle, elbow and wrist arthroplasties have given disappointing results because of their more complex structural and functional properties.

At the spinal level, arthrodesis became, very early, the gold standard of treatment for severe intervertebral disc pathologies. The next logical step was to envision functional replacement, and this step was taken as early as 1956, when the first intervertebral implant was described. However, it took many more years and a great variety of proposed implant designs before clinical applications could be attempted.

The problems in designing a successful intervertebral implant are linked to the three-column structure of the spine, which involves three separate joints at each level. Furthermore, the intervertebral disc is not a true joint, and serves a double func-

tion of mobility and damping, with load repartition properties. To add to the complexity, the center of rotation constantly moves along the three axes. Reproducing this complex structure and function is a challenge well beyond the design of the hip implant, which is mainly a simple ball joint structure. Whereas hip implants represent mainly multiple variations around a common theme, the principles governing the different spinal arthroplasty designs are multiple and totally distinct. The same can be said about the materials used in those designs. This challenge has stimulated the productive imagination of both surgeons and engineers. The ratio between the number of patents and publications and the number of designs that reached the animal implantation level, not to mention clinical use, is enormous. This wide heterogeneity of designs reflects well the complexity of the task involved in the creation of an artificial implant mimicking the nature and function of the disc.

The few designs that are in commercial production and current human use have to withstand the test of time and of evidence-based medicine. There are few prospective studies on this topic, and no true randomized control trial demonstrating the superiority of spine arthroplasty over fusion has been published to this day. We should also be guided by the experience in other areas of

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joint replacement, showing that a great number of problems and complications only become apparent through a process of true long-term follow-up.

Clinical experience with different implants, principles of design and surgical techniques are presented in this volume. Although not a true

joint arthroplasty, ligamentoplasty, nevertheless, uses implants to maintain mobility and is also discussed here.

The different approaches presented in this volume reflect current thought on the subject. New ideas will probably arise and, in the more distant future, the solutions will

probably lie more in possibilities of disc repair by cell biology than in replacement by mechanical hardware.

In the meantime, we hope that the techniques described here will prove their efficacy in methodologically sound studies, and that spinal surgery will join the rest of orthopedic care in the quest for motion.