Bioceramics

Includes tricalcium phosphate, calcium carbonate & hydroxyapatite.

1. PROS: no risk of disease transmission

2. CONS: only recommended for use as bone graft extenders (i.e., must be combined with autograft, bone marrow aspirate, BMP…)

Bioceramics and bioglasses are ceramic materials that are biocompatible.

Bioceramics are an important subset of biomaterials.

Bioceramics range in biocompatibility from the ceramic oxides, which are inert in the body, to the other extreme of resorbable materials, which are eventually replaced by the body after they have assisted repair. Bioceramics are used in many types of medical procedures. Bioceramics are typically used as rigid materials in surgical implants, though some bioceramics are flexible. The ceramic materials used are not the same as porcelain type ceramic materials. Rather, bioceramics are closely related to either the body's own materials or are extremely durable metal oxides.

Ceramics are used in Total Disc Replacements (1) in articulating surfaces for their wear resistance and biocompatibility and (2) on endplates to promote osseointegration. They furthermore exhibit MRI and CT compatibility. These properties address main challenges associated with non-ceramic Total Disc Replacements i.e. wear, migration and postoperative imaging. While brittleness of ceramics caused fear of fracture in the past, improvements of ceramic materials were made and considerable clinical experience with ceramic Total Disc Replacements was gained. Kölle et al. conducted a scoping review on the use of ceramics in Total Disc Replacements using Scopus, Web of Science and PubMed. The review includes 36 clinical, ex vivo and nonhuman in vivo, tribological and mechanical studies and case reports.

Ceramics are used in cervical Total Disc Replacements, with safety and efficacy confirmed in clinical studies, with up to 10 and 3.3 years follow-up, for articulation and osseointegration applications, respectively. Clinical evidence shows that ceramic Total Disc Replacements (alike non-ceramic ones) restore segmental motion and result in non-inferior and possibly superior outcomes to spinal fusion. In vivo studies show osseointegration comparable to non-ceramic devices. Tribological studies suggest appropriate wear properties.

They found no indications of systematic problems with the use of ceramics in Total Disc Replacements. Ceramics are suitable materials for Total Disc Replacements [1].

1)
Kölle L, Ignasiak D, Ferguson SJ, Helgason B. Ceramics in total disc replacements: A scoping review. Clin Biomech (Bristol, Avon). 2022 Oct 13;100:105796. doi: 10.1016/j.clinbiomech.2022.105796. Epub ahead of print. PMID: 36435073.