

## Background & Incidence

There is a lack of clear evidence on the incidence of infection or biofilm formation in any medical application resulting from one medical device over another or one material over another.

- ▶ Post-operative infection rates in spine are typically reported in the range of 2-4%,<sup>1-5</sup> but can be as high as 15%.<sup>6-8</sup>
- ▶ A study by Bible *et al.* found that the following were not significantly associated with implant contamination:<sup>8</sup>
  - Implant type (rods, plates, PEEK)
  - Number of pieces of hardware implanted
  - Number of scrubbed personnel
  - Length of time implant trays left open
- ▶ The only significant factor identified was coverage of implants with surgical towels, reducing contamination rate from 16.7% to 2.0%.<sup>8</sup>
- ▶ *In vitro* studies have shown bacterial adhesion and biofilm formation on biomaterials to be dependent upon topography, surface chemistry, microorganism and even the strain. **In these studies, moulded PEEK performs similarly to titanium.**<sup>9</sup>



Graphic of adherent *Staphylococcus aureus* bacteria

## PEEK & Infection in Spine Surgery

While there is a lack of definitive data implicating specific biomaterials in infection of the spine, there is evidence supporting the use of PEEK cages in pre-existing infection cases, with correspondingly good fusion rates.

- ▶ Pee *et al.* implanted titanium cages in 22 patients, titanium mesh cages in 5 patients, and PEEK cages in 10 patients with pyogenic spondylodiscitis.<sup>10</sup>
  - Resolution of infection was exhibited in all cases.
  - **"We are unaware of any study of PEEK cages becoming infected with bacteria as has been reported with titanium cages."**
- ▶ Shiban *et al.* implanted PEEK cages in 52 patients with pyogenic spinal infection.<sup>11</sup>
  - Complete resolution of infection in all cases.
  - **"Use of PEEK cages for interbody fusion is feasible and safe in patients suffering from a pyogenic spinal infection."**
- ▶ Schomacher *et al.* implanted PEEK cages in 21 patients and Titanium cages in 16 patients with pyogenic spondylodiscitis.<sup>12</sup>
  - **"Application of TTN- or PEEK-cages does not appear to influence the radiological outcome or risk of reinfection."**
- ▶ Walter *et al.* implanted PEEK cages in 5 patients with cervical spondylodiscitis.<sup>13</sup>
  - **"Bony fusion occurs 8 months after the surgical intervention with a complete regression of the inflammatory changes on MRI and normalization of the inflammatory lab signs."**
- ▶ Tschöke *et al.* implanted PEEK cages in 18 patients with lumbar pyogenic spondylodiscitis.<sup>14</sup>
  - No recurrence of infection.
  - **"Based on our experience, the concern of a recurrent infection when implanting non-metallic cages may be refuted in carefully selected patients."**
- ▶ Mondorf *et al.* implanted PEEK cages in 52 patients with cervical spondylodiscitis.<sup>15</sup>
  - Resolution of infection and stable osteosynthesis in all cases.
  - **"Use of PEEK cages for interbody fusion is feasible and safe in patients suffering from a pyogenic spinal infection."**

## PEEK & Infection in Non-Spine Surgery

In applications where infection rates may be expected to be higher, than in post-spine surgery, PEEK shows no greater propensity for infection or biofilm formation.

### DENTAL

- ▶ Peri-implant infections may affect 20% of the patients after 5-10 years of service.<sup>16</sup>
- ▶ Hahnel *et al.* looked at biofilm formation on Titanium, Zirconium and PEEK used for implant abutments.
  - **"Biofilm formation on the surface of PEEK is equal or lower than on the surface of conventionally applied abutment materials such as zirconia and titanium."**<sup>17</sup>
- ▶ Volpe *et al.* sampled bacteria from patients receiving one each; PEEK and titanium healing abutments 2 weeks post-surgery and found bacterial colonization of PEEK and titanium surfaces to be equivalent.<sup>18</sup>

### CRANIOPLASTY

- ▶ A systematic literature review by Punchak *et al.* reported an overall infection rate of 6% for PEEK cranioplasty.<sup>19</sup>
- ▶ Reported infection rates in the literature range between 0-25.9% for autologous graft and 0-11% for titanium mesh.<sup>19</sup>

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