Pin loosening and infection are the major post-operative complications in external fixation. Progressive mechanical deterioration of the bone-pin interface is an inevitable result of fixation with standard pins, regardless of type. This deterioration can lead to pin loosening, thereby contributing to infection of the pin tract. Thus, external fixation is a continual juxtaposition between the growing stability provided by callus maturation and the destabilizing effect of pin loosening.

Measurement Of Pin Loosening

The most precise method to quantify pin loosening is to measure the extraction torque of a pin and compare this measurement with the corresponding insertion torque. A pin extraction torque lower than the corresponding insertion torque is indicative of pin loosening.

In an animal study, the extraction torque of standard tapered pins decreased by 80% at twelve weeks when compared to the corresponding insertion torque. In a clinical study on femur fractures, the extraction torque of standard tapered pins decreased by 83% and 93% respectively at twenty-three weeks, compared to the corresponding insertion torques.

Causes Of Pin Loosening And Infection

Bone-pin fixation is dependent on the integrity of the bone-pin interface. The primary causes of pin loosening and infection are thermal and mechanical damage to the bone during pin insertion and the subsequent fibrous tissue interposition at the bone-pin interface.

Solution

To improve bone-pin osteointegration and bone-pin fixation, OsteoTite® tapered pins coated with hydroxyapatite have been developed.

Pin Looseing and Infection are No Longer a Challenge

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In six weeks, a rod showed significant pin loosening in the standard pins (A), while the OsteoTite pins appeared well-integrated (B).

Pin extraction torque was thirteen times higher in the OsteoTite pins than in the standard pins (p<0.001). No deterioration was observed in the OsteoTite pins. The duration of fixation was found within the period studied.

Standard and OsteoTite pins were implanted in patients treated with femoral or tibial external fixators. Eighty-eight patients received seventy-one standard pins and twenty patients received eighty-six OsteoTite pins. In both cortical and cancellous bone, extraction torque of the OsteoTite pins was higher than the standard pins (p<0.001). Furthermore, a deterioration of the bone-pin interface strength was observed with the standard pins, whereas an improvement of the bone-pin interface strength was observed with the OsteoTite pins (p<0.001). These findings were more evident in cancellous than in cortical bone.

Histology revealed bone erosion and wide gaps at the bone-pin interface with the standard pins (A). With the OsteoTite pins, pin tract infection rate, measured according to the Checketts and Otterburn classification, was significantly lower with OsteoTite pins than with standard pins. Pin tract infection rate, measured according to the Checketts and Otterburn classification, was significantly lower with OsteoTite pins than with standard pins. Pin tract infection rate, measured according to the Checketts and Otterburn classification, was significantly lower with OsteoTite pins than with standard pins.

When standard pins were removed from infected pin tracks, a lower extraction torque than those removed from uninfected pin tracks was observed (p<0.001). However, with the OsteoTite pins, there was no difference in extraction torque between the pins extracted from the infected or uninfected pin tracks. These results demonstrate that even in the presence of pin tract infection, the anchorage of OsteoTite pins is not compromised.

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