The influence of contamination and cleaning on the strength of modular head taper fixation in total hip arthroplasty

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Summary

Krull et al. examined the effect of taper contamination and cleaning on head taper fixation. Cobalt-chromium (CoCr) and ceramic (Ce) femoral heads were impacted with a mean assembly force of 4.3 kN by a standardized method onto commercially available titanium alloy stems. Five conditions were investigated: pristine, contaminated with fat, cleaned after contamination with fat, contaminated with saline and cleaned after contamination with saline. A quasi-static pull-off test was performed to determine the axial disassembly force.

Pull-off forces in pristine conditions were similar for both head materials (Ce: 2'272 ± 337 N, CoCr: 2'288 ± 248 N). Contamination with fat had a dramatic influence on the pull off forces being significantly lower compared to pristine tapers, comparable for both head materials (Ce: 26 ± 16 N, CoCr: 28 ± 21 N). Contrary saline caused only a small reduction in pull-off strength for both materials (Ce: 1'911 ± 1'637 N, CoCr: 2'010 ± 1'827 N).

Cleaning and drying with gauze after contamination with either fat or saline solution yielded similar pull off strength compared to pristine tapers for both materials examined. The authors concluded that intraoperative taper contamination with fat or saline solution has a major impact on the taper fixation strength. They further concluded that drying after cleaning is important for avoiding a large variation in taper fixation.

Study Limitations

Pull-off strength not representative for clinical assembly strength

Large scatter in contaminated results; standard deviations almost as large as the mean values for contaminated surfaces

Different geometrical parameters (e.g. angular gap) and surface structures of tapers and ball heads were not examined

Key Messages

Taper contamination strongly affects taper fixation strength

Huge scatter in the fixation strength of contaminated tapers if not clean and dry

No difference between ceramic and metal heads

Cleaning the stem taper with saline and gauze and drying with gauze is very effective to achieve almost pristine pull-off strength

Intraoperative cleaning and drying of tapers is an important step to guarantee sufficient taper fixation strength

Commentary

Basic scientific paper that confirms clinical experience findings. Contamination is well known to reduce the burst strength of ceramic femoral heads and also the stability of the taper connection of modular hip prosthesis. With respect to the increased potential of fretting and tribo-corrosion optimal assembly of modular connections is one of the key factors for reducing its incidence, especially when metal heads are used.