

# Metal Ion Levels in a Modular Neck Total Hip Replacement System

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## Introduction:

Modular necks for total hip replacement were introduced over two decades ago in order to optimize hip biomechanics as well as minimize risk of impingement. Having said that, any modular junction is subject to fretting and corrosive wear which could lead to metal ion release. As there is potential for an adverse reaction to metal debris (which may require revision), ongoing clinical evaluation of metal ion levels is of interest. The goal of the present study is to analyze serum metal ion data (chromium, cobalt and titanium) within the first two years following total hip replacements using a modular neck system.

## Methods:

As part of a randomized controlled trial, 50 patients (27 males, 23 females, mean age=61.6±6.4, mean BMI=30.0±5.2) underwent a hip replacement with a modular neck system: Pro-Femur System from Wright Medical Technology. Twenty-five patients received a metal-on-metal (MoM) bearing with an all cobalt chromium molybdenum (CoCrMo) shell, and the remaining 25 received a metal-on-polyethylene (MPE) with a titanium shell. Serum ion levels (chromium, cobalt, titanium) were measured at baseline (10-14 days post-surgery), as well as at 1 year and 2 years post-operatively using inductively coupled plasma mass spectrometry (ICPMS). All results are reported as median values, in µg/L (parts per billion).

## Results:

At baseline, median ion values for all patients (MoM and MPE) were 0.19, 0.17, and 0.24 ppb (chromium, cobalt, titanium, respectively), increasing significantly to 0.60, 0.71, 2.48, respectively at 1 year ( $p<0.001$ ), and with no significant change at 2 years (0.60, 0.66, and 2.55, respectively).

When comparing MoM to MPE groups, MoM group had significantly higher median chromium (1.27 vs. 0.22;  $p<0.001$ ) and cobalt (2.18 vs. 0.26;  $p<0.001$ ) levels at 1 year. Titanium levels reached 2.03 and 2.56 ppb for the MoM and MPE groups, respectively, with no significant difference between the two groups ( $p=0.11$ ). At the 2-year mark, the median chromium and cobalt levels remained significantly higher in the MoM group compared to the MPE group (1.59 vs. 0.28;  $p<.001$  for chromium, and 2.10 vs. 0.26;  $p<.001$  for cobalt). On the other hand, titanium levels were significantly lower in the MoM group (1.54 vs. 2.73,  $p=0.03$ ). One patient in the MoM group underwent revision at 11 months post-op due to aseptic cup loosening.

## Discussion and Conclusion:

This study shows that modular femoral necks result in increased titanium ion levels. In addition, the presence of titanium shell lead to higher titanium levels in the MPE group when compared to the MoM group. No adverse events related to the modular necks have been noted but further follow-up is needed.