

## Metal Ion Testing Protocol

1. We recommend routine blood testing of Cobalt, Chromium, and Titanium in all total joint patients containing cobalt chrome implants. This includes hips and knees.
2. Laboratory:
  - a. Quest is the lab chosen for our tests. Blood levels (as opposed to serum or plasma) is preferred.
  - b. PNE Hospital sends their samples to Quest.
  - c. Quest has branches throughout the US. Patients can look up a local branch online.
  - d. If patients use other labs, results may not be comparable.
3. Testing schedule:
  - a. Routine Blood will be drawn starting at 2 years postop. Again after 1 or 2 years only in certain patients.
  - b. If a patient is already more than 2 years postop, they can have a test anytime
  - c. It is best that patients get blood tests 4 weeks prior to an office visit if possible; they should bring the results with them.
  - d. Patients must refrain from ALL vitamins and supplements for 1 week prior to the blood test (some of these contain Chromium). Regular prescription meds should not be interrupted.
4. Initially after surgery the levels are higher, at 2 years they stabilize. Therefore we begin to monitor when patients reach a steady state at 2 years.
5. In over 3500 resurfacings and over 1000 metal on metal hip replacements with regular follow-up, adverse reaction to metal wear debris (AWRF) has only been seen in cases with cobalt or chromium above 15ug/L. The average level for AWRF cases is 70ug/L. We have never seen evidence for systemic toxicity in any of our AWRF cases.
6. Cobalt and chromium are normal elements in our diet and metabolic systems. Chromium is a supplement in most multivitamins. Normal levels of cobalt or chromium in the blood are below 1.5Ug/L. Most patients with metal bearings have somewhat elevated levels. We consider a level under 10ug/L as normal for metal bearing implants.
7. We suspect, but are not yet certain, that one low level after 2 years indicates a permanent low wear state.
8. Patients with levels above 10ug/L need additional evaluation and closer monitoring. We recommend a metal suppression CT or MRI (CT if bilateral

implants) and repeat ion levels in one year. They typically do not require revision surgery.

9. Recent data from VanderStraeten and DeSmet indicates reversible systemic symptoms can sometimes occur with blood levels above 20ug/L, therefore consideration should be given to revise these rare cases even if there are no hip symptoms.
10. In patients with cup angles (acetabular inclination angles AIA) under 50 degrees we have never seen an AWRP. Above 50 degrees the rate of AWRP is only 5%. Because this is the group at risk, we are currently recommending a repeat ion level 2 years after the initial test even if the first test was satisfactory.
11. Also, patients with implant failure for any cause or those that have significant unexplained pain are tested.
12. Total knees have cobalt chrome components and have been shown to have similar ion levels as metal-metal hip implants. Therefore all joint implants will be monitored.
13. Before I operate on anyone with any joint implant I will test ion levels at baseline.