

## Univ. Prof. Dr. habil., Ph.D. M. M. Morlock

# Mix & Match

Cone connections for modular joint replacement prostheses are currently receiving a great deal of attention. Insufficiently joined connections carry the risk of increased relative movement at the cone contact surface, with consecutive friction and crevice corrosion or even cone fracture. Four aspects must be taken into consideration to ensure proper joining: (1) suitable components, (2) clean joint surfaces, (3) sufficient joining force and (4) adequate mechanical load in patients. The first aspect is the most significant of the four, as considering the other three factors unfortunately does not help if a “critical” mismatch occurs. So the question is:

### At what point is a mismatch “critical”?

The answer to this is surprisingly simple: the mismatch is critical whenever problems arise with the connection. The cone designs on the market are largely based on empirical processes, rather than analytical calculations. As such, it is practically impossible to determine the line between “acceptable” and “unacceptable”. The manufacturer must ensure that no problems arise among those of its components approved for use in combination. Unfortunately, even that is not always guaranteed, as the current problems demonstrate. To date, scientific studies have focused only on the risk of breakage with incorrect combinations involving ceramic heads, not on the relative movement between two ill-fitting components, which is decisive.

This is further complicated by the fact that cone geometries are not standardised and cone designations are not unambiguous. Taper geometries are commonly abbreviated using two numerical values (e.g. 10/12, 11/12, 11/13, 12/14, 13/14, 14/16) or by specifying the angle (V-40 ~ 5 degrees 40 minutes). These numerical values originated from the technical definition of cone geometry, and correspond to the diameters at the proximal and distal ends of the cone with a taper length of exactly 2 cm. With a 12/14 cone, this corresponds to a taper angle of 5 degrees 43 minutes and 30 seconds. To achieve a defined lock between head and stem at specified manufacturing tolerances, their nominal taper angles are usually not identical. The difference between these angles may be different from one manufacturer to the next. Manufacturers do not reveal such information, and the components are still all labelled the same.

You do not need to understand all of that, though. The important thing for you to know is that you are taking an unnecessary risk by using combinations that have not explicitly been approved (and tested) by both manufacturers. If nothing happens - lucky you! If something happens - you will have to demonstrate explicitly why you chose that combination. As such, if there is any way to avoid it... don't mix and match!

### With revision surgeries, the situation is somewhat different.

For the good of the patient, if his or her medical records do not clearly identify the cone type and there is no way of finding it out, stem revision may be omitted in favour of “roughly” determining the cone type intraoperatively, e.g., using a BioBall AdapterSelector. In such cases, however, it is best to use a head with a titanium adapter sleeve, as these can be adjusted to existing cone geometry more effectively.



BioBall® AdapterSelector™  
to determine stem type.



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