RE: Biomechanical comparative analysis of temporomandibular joint, glenoid fossa and head of the condyle of conventional models prothesis with new PEEK design

A B S T R A C T

This is a Letter to the Editor that describes some of the biomechanical concerns with the statements made in This is a LTE that raises some biomechanical statements made in Genovesi W, Comenale IC, Genovesi Filho W, Veloso Fernandes M. Biomechanical comparative analysis of temporomandibular joint, glenoid fossa and head of the condyle of conventional models prothesis with new PEEK design. J Oral Biol Craniofac Res. 2022 Sep-Oct; 12(5):529-541.

To the Editor

First, we would like to commend the authors’ attempts to improve the field of alloplastic temporomandibular joint replacement (TMJR). Exhaustive preclinical biomechanical studies are necessary for improvement of the current TMJR device embodiments, materials, design, and manufacturing. In the current era of metal-on-polyethylene (MoP) TMJR devices, it is important to build on the long-term clinical data available to improve future device embodiments. In addition, given the storied history of catastrophic embodiment failures (e.g., Proplast Teflon), paired with the clinical success of the newer generation of MoP TMJR devices, the bar is now set high, and it is the surgical communities responsibility to ensure that extensive preclinical biomechanical and robust clinical trials occur and are reported before a new TMJR device is widely implemented, particularly when new elements of embodiment are being considered. While this paper has novel biomechanical information, we respectfully disagree with some of the assumptions and conclusions in this paper.

We disagree with the statement that “All glenoid fossas have the same design.” It should be noted that the differences in the Stryker/TMJ Concepts (Ventura, CA) and Zimmer Biomet (Jacksonville, FL) TMJR fossa designs with unclear clinical significance. This includes the presence and size of the posterior stop, the size of the lateral flanges, and the depth and curvature of the articulating surfaces. In this article the authors’ primary concern is fossa design and dislocation. It is noteworthy that this has not been a clinically significant cause for either TMJR device revision or removal. In fact, generally a dislocated device can be salvaged with reduction and a brief period of maxillomandibular fixation.

Concerning screw fixation and position of the mandibular components, we appreciate the authors’ detailed evaluation of screw position and lever arm forces assessment between the current MoP devices. However, it is worth noting that many other known and unknown factors contribute to device stability, including the number, position, pattern, and distance of the fixation screws from the rotation force at the most superior screw. As reported by Hsu J-T et al., once beyond three fixation screws there is limited impact on device stability with more screws.

While the best position and number of screws is still an important question, device loosening and failure in current MoP devices remains an insignificant contributor to device failures.

The present MoP devices show survivorship at 10 years >95%.

Therefore, prior to TMJR devices with new embodiments introduction into human trials, it is essential that wear rates from preclinical biomechanical studies of be conducted and reported. The authors state, “A prototype TMJ prosthesis was developed with this material (PEEK) and after exhaustive testing done in a laboratory, performed exceptionnally well and had no damage on its surfaces after multiple laboratory tests.” Inclusion or citation of this data would be important for the readers to make proper conclusions about the feasibility of PEEK TMJR devices.

Finally, PEEK and CFR-PEEK materials were explored as an alternative for polyethylene in a low conformity knee replacement through an experimental wear study. Extremely high wear rates were reported for both materials with evidence of cracking and material failure seen within the wear region. It is likely the low conformity geometry resulted in high contact stress conditions caused localized mechanical failure of the material.

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