NUMERIC COMPARATIVE STUDY OF TMJ IMPLANT "STRAIGHT, SEMI-ANATOMIC AND ANATOMIC"

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INTRODUCTION

There are several diseases that can affect the human temporomandibular joint (TMJ), among which we highlight the cancer, trauma or fracture, a congenital malformation, osteochondritis [1]. In the United States TMJ diseases may affect 30 million people. While a vast majority of these patients can be treated without surgery, a small group requires surgery [2]. The pain relief and functional recovery of the joint are the most frequent causes for the achievement of the TMJ arthroplasty [3]. Although implants have records of successful long-term widely documented, the recent arrival of failures and complications related to placement of such implants again feed the discussions [4]. The present study used a finite element technique so simulate three variaton of geometries in a comercial TMJ implant.

METHODS

One model of the mandible was based on a polymeric replica of a human mandible from the manufacturer Sawbones®. The model was obtained by a 3D shape acquisition of the mandible in a 3D laser scan-ning (Roland LPX 250). The complexity of the geometry involved the completion of ten scans presenting different orientations. The resolution was 0.2 x 0.2mm.

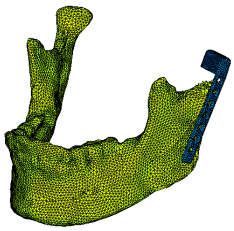

Figure 1: CAD mandible model equipped with plate implant.

This study compared also three geometries of the implant keeping the same philosophy of fixation. The geometry of implant changes with straight, semi-anatomic and anatomic. A previous study ensured the convergence. The boundary conditions were the followings: the incisive tooth was fixed in three directions and could rotate, and the condyles could slide on the plane surface of the support. The loads were defined in table 1 to a mouth opening of 5mm which is the condition that causes the most critical situation on the condyle. The implants are fixed using four screws and, as often, there is no screw in the higher position.

Table 1: Muscular actions (N).

	Loading(N)		
Muscles actions	**x**	**y**	**z**
Masseteur Profund	7,776	127,23	22,68
Masseteur Superficial	12,873	183,5	12,11
Petirogen Medial	140,38	237,8	-77,3
Temporal anterior	0,064	0,37	-0,13
Temporal Moyene	0,97	5,68	-7,44

RESULTS AND DISCUSSION

The figure 2 represents the displacement on 3 situations, intact mandible and with three different implants on same position. The results show non symmetric behavior of intact and implanted mandible. The anatomic TMJ implant has a displacement more similar to the intact mandible. On the contrary the semi-anatomic TMJ implant not revealed a improved behavior relatively to the straight one. The stiffness on implant will be an important factor on strain distribution. The number of screws only affects the strain distribution on the fixation area near the condyle.

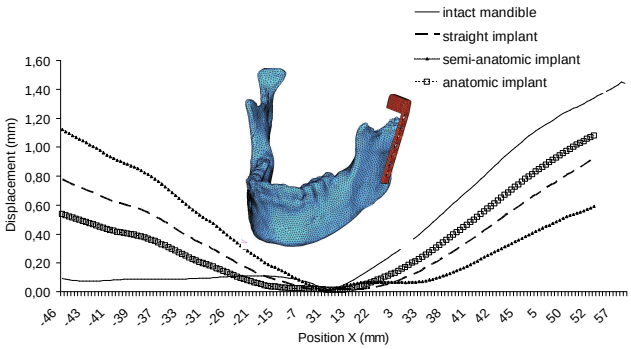

Figure 2: Displacement mandible behavior intact and with TMJ implant.

CONCLUSIONS

The study shows is not a requisite to be semi-anatomical implant to have better behavior. There are other mechanical factors that may influence their behavior. Furthermore it was observed that the support of the condyle is an important factor in the mobility of the joint. The anatomical implants showed a uniform distribution of the field of deformation, enabling the integration of bone screws, which may occur with the implant or semi-anatomical rectum. Should be studied to its rigidity and structural integrity, as the anatomical implant is subject to more severe mechanical stresses and may fracture zone in the first hole because of the concentration of tensions.

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