TEMPOROMANDIBULAR JOINT MODEL: ANATOMICAL COMPARISON BETWEEN HUMAN AND RAT

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INTRODUCTION

The human temporomandibular joint (TMJ) is a group of anatomical structures that, with a special group of muscles, is responsible for the movement of the mandible during mastication. It consists of the condylar process of the mandible, the mandibular fossa of the temporal bone, a thin articular disc, and a loose joint capsule, which is strengthened by a fibrous lateral ligament [1]. This joint, which is classified as a hinge-sliding joint, has a unique structure and function as compared with other diarthrodial joints [2].

Innumerable diseases, such as neoplasias, trauma, ankylosis and degenerative diseases may affect the TMJ and lead to the loss of its structures. This pathological condition of TMJ is regarded as the TMJ disorder. For all these diseases there are specific treatments, each of which has a wide range of success. As a result there is always a need for progress in the treatment of some of these diseases. Furthermore much of the research in this area cannot be done on humans for ethical reasons. Studies in vitro and animal models may be used for this purpose [3]. In particular, rats may be used since they are easy to handle and inexpensive to maintain in a bioterium, making them a convenient animal for use in experimental studies.

MATERIALS AND METHODS

Formalin fixed twelve adult male Wistar Albino rat specimens were used in this procedure. The various anatomical structures of TMJ were evaluated such as condyle, mandibular fossa, disc, articular tubercle and temporal bone of rat was compared to that of humans.
The following tissues were removed: skin, subcutaneous tissue, blood vessels, nerves, parotid gland, masseter muscle, temporal muscle and adipose tissue. Then the TMJ is exposed to show zygomatic arch, ramus of mandible, temporal bone, condylar process and articular eminence. All these structures were compared after dissecting the human TMJ.

RESULTS

The TMJ is surrounded by a thin capsule, consisting of fibrous tissue and a synovial lining. The mandibular angle has a prominent shape. The glenoid fossa is flat, with no eminences. The articular disc is biconcave, being less thick in the central area; and is made up of fibrous connective tissue. It divides the articular joint into two compartments: superior and inferior. In all specimens the anatomical characteristics were almost similar (Figure 1).

DISCUSSION

If there is a need for reconstruction of the TMJ, autogenous tissue and alloplastic material may be used. However, neither of the treatments is ideal, since both have their drawbacks [1]. Thus, studies dealing with the surgical treatment of diseases of the TMJ need to be conducted for the purpose of producing fresh ideas on innovative treatments. Many of these may certainly be performed on animals.

Innumerable species may be used for this purpose, such as monkeys, rabbits, sheep, goats and minipigs [5]. Study models in rats would therefore certainly represent an advance in terms of cost and ease of performance. Thus it is important to know how similar the TMJ’s of rats and humans are.

As far as anatomical features are concerned, it is important to point out that the size of the rat joint is much smaller than the humans and the main difference between them is that there is no articular eminence in the rat TMJ. The position of the condyles is also divergent. In addition, the shape of the mandibular angle is different, since in the rats this angle is more prominent. The absence of the articular eminence may make the movement of the mandible highly specialized for extensive protrusive movements. The rounded condyle travels in a trough-like temporal fossa and the power stroke is in the protrusive direction with only a minor medial component1. Since the mandibular symphysis is fibrous, rotation of the long axis may occur around this mobile symphysis [6,7].

CONCLUSION

Morphologically and anatomically, the articular structure of rat TMJ is, on the whole, similar to that of humans. Except in these animals there is no articular eminence. Other structures are similar depicting these species may be used for this purpose to model TMJ of rats.

References

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Figure 1 Photographs showing comparison of TMJ between rat and human
1. Masseter 2. Temporal bone 3. Zygomatic arch 4. Ramus of mandible 5. Condylar process 6. Articular eminence 7. Mandibular fossa