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Intraarticular Injections Experimentally Induced Osteoarthritis in Rat Temporomandibular Joint

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Abstract

This study is to investigate the changes of Temporomandibular Joint (TMJ) by experimentally induced osteoarthritis (OA) and to compare effectiveness of intraarticular injections. Intraarticular Monosodium Iodoacetate (MIA) solution was injected bilaterally to experimental groups to induce TMJ osteoarthritis. 0•9% NaCl solution was injected to TMJ of healthy control group bilaterally to investigate the effect of trauma by intraarticular injection. For treatment group were injected intraarticularly with Hyaluronic Acid (HA), second subgroup with Dexamethasone (DEX) and third subgroup with Botulinum Toxin A (BTX A). Groups treated with HA and DEX showed statistically significant healing compared with untreated MIA group.

Keywords: TMJ; Osteoarthritis; Monosodium iodoacetate

Introduction

Synovial membrane, synovial fluid, disc and fibrocartilage play role in TMJ lubrication. The main lubricating factor is synovial fluid, and the main content of the synovial fluid is HA. Due to its high viscosity, HA in the synovial fluid keeps the joint surfaces away from each other under low forces, because HA sticks to surface-active lipids and prevent them from degradation due to the action of phospholipase [1]. OA is an inflammatory joint disease characterized by loss of subchondral bone and joint cartilae (degeneration) accompanied by proliferation of soft tissue and new bone [2,3]. One of the most important features of OA pathogenesis is decreased HA concentration in serum. Available experimental OA models include surgical models, mechanical OA model, drug-induced OA model and spontaneous OA [4,5]. Drug-induced OA model has been the most preferred method in studies, because it is easy to perform, reproducible, it induces OA in a rapid time and causes clinical and pathological signs that are close to what is seen in the actual disease [6]. MIA model of OA that we used in the present study has been used many times in the literature and has a proven effect [6].

In order to induce experimental OA, 1 mg/kg monosodium iodoacetate (MIA, Sigma, Saint Louis, USA) diluted in 50 µL 0.9% NaCl solution was injected to upper compartment of bilateral TMJ of 54 male Sprague Dawley strain rats in Groups II, III, IV, V and VI, using 27-gauge 0.5-inch injector, as described by Wang et al in 2012. In addition to these groups, another group was formed comprised of 7 rats again in group VII, and only intraarticular 0.9% NaCl solution was injected to the rats in this group without inducing OA. We waited 4 weeks for development of experimental osteoarthritis. At the end of 4th week, intracardiac blood samples obtained from rats in Group II were sent to biochemical analysis. To demonstrate OA development, TNF-α level in these blood samples were analyzed with Ray Bio® Rat TNF- α ELISA Kit, according to manufacturer's instructions. In groups III, IV and V, which had experimentally induced bilateral TMJ OA, three different substances were administered to animals via intraarticular injections for treating TMJ OA as follows: 0.12 mg/kg HA diluted in 50 µL 0.9% NaCl solution in group III; 1.2 mg/kg DEX diluted in 50 µL 0.9% NaCl solution in Group IV; and 5 units/kg BTX A diluted in 50 µL 0•9% NaCl solution in group V. After a predetermined treatment period of 6 weeks, all animals were sacrificed, via drawing intracardiac blood.

Results

The number of TMJ's with cartilage lesion in the group that had induced OA with group II was significantly higher compared to reference group I, group III, group VI and the group of healthy animals that only received group VII ($p<0.05$). Various preparations can be used

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intraarticularly in TMJ OA. These include high molecular weight HA [7], corticosteroids [8], and BTX A that is injected to masseter and temporal muscles under EMG guidance [7-9]. In our study, after biochemical demonstration of OA development, we performed intraarticular injections with HA, DEX and BTX A, and we compared their histopathological and biochemical effects on the course of disease with each other and in reference to control groups. In order to determine the effects of the trauma caused by the cannula used to administer intraarticular injections, we administered only 0.9% NaCl solution to a group of healthy rats that did not have induced OA. In this group, although mean serum TNF-α level was found to be slightly higher in comparison to healthy animals, the difference was not statistically significant. Similarly, pathological examination of their TMJ did not reveal any damage to the cartilage. Therefore, it was concluded that the injection procedure itself did not cause any significant mechanical trauma to the joint.

Conclusion

Based on the results of comparative investigation on treatment in TMJ OA, we found that HA was the most successful agent and could be safely used in treatment. Nevertheless, more comprehensive clinical studies are necessary to apply these findings to the clinical practice, since animal studies have some disadvantages such as different TMJ anatomy, dentition, occlusion mechanisms and masticatory habits of the animals, and also that conservative therapeutic approaches that could be applied in clinical studies cannot be used in animal studies.

References

1. Singh RK. Temporomandibular joint disorders. Natl J Maxillofac Surg. 2016;7(1):1-2.
2. Bourbon B. Craniomandibular Examination and Treatment. Myers RS. Saunders Manuel of Physical Therapy Practice. Philadelphia: W.B. Saunders Co, 1995.
3. Sindou M, Tatli M. Treatment of trigeminal neuralgia with glycerol injection at the gasserian ganglion. Neurochirurgie. 2009;55(2):211-2.
4. Freund B, Schwartz M. The use of botulinum toxin for the treatment of temporomandibular disorder. Oral Health. 1998;88(2):32-7.
5. Freund BJ, Schwartz M. Intramuscular injection of botulinum toxin as an adjunct to arthrocentesis of the temporomandibular joint: preliminary observations. Br J Oral Maxillofac Surg. 2003;41(5):351-2.
6. Meng J, Ma X, Ma D, Xu D. Microarray analysis of differential gene expression in temporomandibular joint condylar cartilage after experimentally induced osteoarthritis. Osteoarthritis Cartilage. 2005;13(12):1115-25.
7. Ghassemi Nejad S, Kobezda T, Tar I, Szekanecz Z. Development of temporomandibular joint arthritis: The use of animal models. Joint Bone Spine. 2017;84(2):145-151.
8. Guarda-Nardini L, Masiero S, Marioni G. Conservative treatment of temporomandibular joint osteoarthrosis: intra-articular injection of sodium hyaluronate. J Oral Rehabil. 2005;32(10):729-34.
9. Kurtoglu C, Gur OH, Kurkcu M, Sertdemir Y, Guler-Uysal F, Uysal H. Effect of botulinum toxin-A in myofascial pain patients with or without functional disc displacement. J Oral Maxillofac Surg. 2008;66(8):1644-51.