

Tissue Engineering for Mandibular Bone Lengthening in Smokers

L.K. Cheung, L. Ma, L.W. Zheng

Oral & Maxillofacial Surgery, The University of Hong Kong

It is a clinical challenge to treat heavy smokers due to their compromised healing ability, particularly on the need for reconstructive surgery in craniofacial deformities or tumor treatment. Nicotine is one of the major components in tobacco products responsible for tobacco addiction. It is known to cause the retardation of skeletal development and bone tissue healing. Distraction osteogenesis is a newly developed technique to treat severe craniofacial deformities. It provides a tool to explore the biochemical mechanism of bone induction and formation.

This study attempts to establish a nicotine-induced compromised bone healing model of rabbit mandibular distraction osteogenesis.

Twenty New Zealand white rabbits were randomly assigned to 4 groups: low dose nicotine of (0.75g), high dose nicotine (1.5g), placebo control, and sham control. 60-day time release nicotine pellets and placebos were embedded subcutaneously. One week after nicotine embedding, osteotomy and active distraction was performed. Plasma nicotine levels were measured before nicotine embedding, on the day of osteotomy and before sacrifice. After seven weeks exposure of nicotine, the rabbits were sacrificed and the mandibular samples were subjected to plain x-ray, micro-CT and histological study.

The plasma nicotine levels in the low dose nicotine group were less than 9.0ng/ml, and in the high dose nicotine group were in the range from 20.9-47.4ng. When compared to control groups, the bone healing process was significantly

compromised only in the high nicotine dose group.

The rabbits administrated with time-released nicotine pellets can simulate human smokers. The plasma nicotine level attained in the high dose nicotine group was equivalent to the nicotine concentration (10 to 49ng/ml) commonly observed in human heavy smokers, whereas the low dose nicotine group was comparable to the light smokers. When compare to the control groups, nicotine exposure in high dose for seven weeks has a significant impact on the bone healing during the rabbit mandibular distraction osteogenesis.