Abstract

Problems with musculoskeletal system, such as of developmental disorders, fractures or damage of the bone by age, inflammatory or tumor diseases, are still increasing in orthopaedics. Sometimes the bone tissue is not capable to completely regenerate to exert its physiological function in the organism. For this reason, using the bone replacements is necessary and common nowadays. Despite of an intensive research and testing of a wide range of the potential biomaterials and their combinations, the usage of metal materials for construction of the bone implants, still remains to be the gold standard. Ti-6Al-4V alloy is one of the commercialy used metal materials, which is known for the high mechanical and chemical resistance and a good biocompatibility. For a good biological response of the patient's organism for the bone implant, is an ability of osteointegration into the surrounding bone tissue, the key. This ability can be influenced in the case of the metals, by their surface structure. As it is known from earlier studies, the surface topography of the material is very important for the adhesion and proliferation of the bone cells, which are able to discriminate, very sensitively, between various stages of the material surface roughness. For this reason we have focused on studying of an influence of the surface modifications of the metal materials (like roughness, wettability and polarity) for the best osteointegration, mechanical and chemical endurance of the prospective bone implant and the support of the bone tissue regeneration by its own cells.

It seems that the problems with an increasing obesity in the human population and the treatment of the bone defects have nothing in common, but by the consumption of an abundant fat tissue we can help not only the obese patient, but also to the person with musculoskeletal system disorders. The solution is hidden in the mesenchymal stem cells, which are present in a fat tissue, called ASCs (adipose-derived stem cells). These adult stem cells have a big potential thanks to their ability to differentiate into many different cell types, immunomodulatory effects and the secretion of an important chemicals which are influencing the healing in the body in a positive way. ASCs are nowadays thanks to these properties in the centre of an interest. Thanks to the recycling of consumpted fat tissue, which is normally going to waste, we can use the adipose-derived stem cells also for bone tissue engineering, where can be these cells applied on the bone implants after their osteogenic differentiation. After that, the implants, which are colonized by the differentiated stem cells, can support natural osteogenesis and better osteointegration of the implant. In this diploma thesis we have found out that the amount of the negative pressure used during the liposuction, have a big influence on the properties of the isolated stem cells. The cells which were obtained under lower negative pressure (-200 mmHg), had lower proliferation activity, but higher ability of osteogenic differentiation. On the other hand stem cells isolated under higher negative pressure (-700 mmHg), have been proliferating much faster, but they have been worse in case of the differentiation into the osteoblasts.

Key words: ASCs, Ti-6Al-4V alloy, cell adhesion, osteogenic differentiation, FGF-2