IntelliDrug implant for medicine delivery in Alzheimer’s disease treatment

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The aim of the IntelliDrug project was to develop electronically controlled drug delivery system to provide an alternative approach for the treatment of opiate addiction and chronic diseases (Alzheimer’s disease and diabetes).

Social issue of Alzheimer’s disease is increasing together with world’s population ageing. In 2000, there were 4.5 million persons with this disease in the US population. By 2050, this number will increase to 13.2 million. Galantamine hydrobromide is an acetylcholinesterase inhibitor and was approved by FDA for Alzheimer’s treatment in 2001. Following oral administration, galantamine is 100% bioavailable, but this route has some disadvantages. Alzheimer's disease is the most common cause of dementia. Sufferings have to take the medicine twice daily, but loss of memory very often makes impossible to do this by themselves which leads to low compliance. Additionally the oral administration of galantamine gives negative gastrointestinal side effects: bigger gastrointestinal tonus and peristaltic activity in the stomach and ileum, spastic reactions in the duodenum, acceleration of the evacuation kinetics. It is advisable to work out new route of galantamine delivery and new formulation.

IntelliDrug it is a tooth or denture implant (Fig. 1.) containing a drug reservoir and electronic release control system. The non-keratinized buccal mucosa which is highly vascularized enables local and systemic delivery of drugs, but the buccal has absorption area limitation and washing effect of saliva decrease amount of taken medicine. The solution of these problems is to enhance the galantamine transport velocity. The IntelliDrug implant overcomes difficulty by means of iontophoresis. Iontophoresis is the application of an electrical potential across the tissue that causes a movement of charged particle of medicine. It is a noninvasive and painless method applied for transport drugs through skin at present.

Research works showed that iontophoresis enables controlled release and increase of galantamine transport via buccal mucosa. In the experimental study a two-chamber permeation cell with silver electrodes has been developed to carry out in vitro iontophoresis. Considerable increase of mass transfer was observed after application of current density 1 mA/cm$^2$. The influence of initial drug concentration for transport velocity was shown.

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Fig. 1. IntelliDrug implant.