令和７年度　大学院歯学院（前期）　入学試験問題　英語

2025 English

The entrance examination to Graduate School of Dental Medicine, Hokkaido University

Question I.

Read the following article, and answer the questions.

Your answers should be written in English on the Answer Sheet I.

Foreign body reactions to implants are among the most critical challenges that undermine the long-term functionality and reliability of biomaterials and devices in vivo. In particular, the formation of a fibrous capsule between the implant and the target tissue, as a result of foreign body reactions, can substantially compromise the implant's efficacy because the fibrous capsule acts as a barrier to mechanical, electrical, chemical or optical communications. To alleviate the formation of the fibrous capsule at the implant–tissue interface, various approaches have been developed, including drug-eluting coatings, hydrophilic or zwitterionic polymer coatings, active surfaces and controlling the stiffness and/or size of the implants. However, despite recent advances, the mitigation of fibrous capsule formation for implanted biomaterials and devices remains an ongoing challenge in the field, highlighting the importance of developing new solutions and strategies.

Here we demonstrate that an adhesive interface can not only provide mechanical integration of the implant with the target tissue but also prevent the formation of observable fibrous capsules at the implant–tissue interface. We reason that the conformal interfacial integration between the adhesive implant and the tissue surface can reduce the level of infiltration of inflammatory cells (for example, neutrophils, monocytes, macrophages) into the adhesive implant–tissue interface, resulting in a decreased level of collagen deposition and a reduced level of fibrous capsule formation in the long term. By contrast, conventional non-adhesive implants usually do not form conformal integration with the tissue surfaces and attract the infiltration of inflammatory cells into the non-adhesive implant–tissue interfaces. Subsequently, fibrous capsules form on the non-adhesive implant–tissue interfaces.

To test our hypothesis, we prepared an adhesive implant consisting of a mock device (polyurethane) and an adhesive layer composed of interpenetrating networks between the covalently crosslinked poly(acrylic acid) *N*-hydroxysuccinimide ester and physically crosslinked poly(vinyl alcohol). The adhesive layer provides highly conformal and stable integration of the implant with wet tissues. We further prepared a non-adhesive implant by fully swelling the same mock device and adhesive layer in a phosphate-buffered saline bath before implantation. By swelling the implant in phosphate-buffered saline, we removed its adhesive property while keeping its chemical composition identical.

Both adhesive and non-adhesive implants were implanted on the surfaces of diverse organs, including the abdominal wall, colon, stomach, lung and heart, using rat models in vivo for up to 84 days. Note that the non-adhesive implant was sutured onto the organ surfaces. Macroscopic observations showed that both adhesive and non-adhesive implants remained stable at the implantation site on the organ surfaces.

To analyse the foreign body reaction and fibrous capsule formation for the adhesive and non-adhesive implants, we carried out histological analysis of the native tissue, adhesive implant and non-adhesive implant for various organs.

Histological evaluation by a blinded pathologist indicates that the adhesive implant forms conformal integration with the organ surface and shows no observable formation of the fibrous capsule up to 84 days post-implantation for diverse organs, including the abdominal wall, colon, stomach, lung and heart. Furthermore, a transmission electron micrograph of the adhesive implant–tissue interface shows that the adhesive layer maintains highly conformal integration with the collagenous layer of the mesothelium on a subcellular scale on day 28 post-implantation. By contrast, the non-adhesive implant undergoes substantial formation of the fibrous capsule at the implant–tissue interface for all organs, consistent with the foreign body reaction to the mock device alone. Similarly, the mock device–cavity interface of the adhesive implant undergoes fibrous capsule formation.

-Source-

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Question II.

Read the following article, and answer the questions.

Your answers should be written in English on the Answer Sheet II.

Flossing your teeth may protect against cognitive decline, research shows

Flossing your teeth isn't just important for keeping your dentist happy – it may also protect against cognitive decline. Good oral health habits like brushing and flossing may prevent cognitive impairment and dementia, according to a new analysis led by researchers at NYU Rory Meyers College of Nursing. "Given the staggering number of people diagnosed with Alzheimer's disease and dementia each year, and the opportunity to improve oral health across the life span, it's important to gain a deeper understanding of the connection between poor oral health and cognitive decline," said Bei Wu, a professor in global health at NYU Rory Meyers College of Nursing and the senior study author, in a statement. Researchers analyzed 14 studies on tooth loss and cognitive impairment conducted over an extended period of time, which involved a total of 34,074 adults and 4,689 cases of people with diminished cognitive function. The results showed that adults with more tooth loss had a 1.48 times higher risk of cognitive impairment and 1.28 times higher risk of dementia, even when other factors were controlled. And with each additional missing tooth, the risk of cognitive impairment grows, according to the analysis published in JAMDA: The Journal of Post-Acute and Long-Term Care Medicine. Adults who experienced tooth loss were more likely to have cognitive decline if they did not have dentures, the new research also revealed. "We need to think about increasing awareness of the importance of oral health, and we also need to think about preventive treatment and dentures," Wu told CNN. Dentures are important because they allow patients to maintain a healthy diet, as well as provide "the confidence to smile naturally," according to Dr. James Wilson, president of the American Academy of Periodontology, who was not affiliated with the study. "Being able to eat a normal diet is extremely important to a person's physical health," Wilson said via email. "The positive self-image that dentures provide a patient works to improve their mental health as well."

Healthy mouth, healthier brain

The analysis offered several explanations for those links between poor mouth health and poor brain health, including the problem of missing teeth, which can impact chewing, which limits the options for healthy food and can even lead to the loss of key nutrients for brain health. The analysis also highlighted evidence that oral inflammation is connected to brain inflammation and cognitive impairment. "Untreated gum disease can lead to tooth loss and may also increase the risk of developing other health complications," Wilson added. "Inflammation as a result of gum disease has been linked to other disease states, including cardiovascular disease, pancreatic cancer, diabetes, rheumatoid arthritis and Alzheimer's disease." Previous studies have

also found links between P. gingivalis – the bacteria associated with gum disease – and Alzheimer's, Wilson told CNN.

Socioeconomics play a role

The NYU-led analysis also noted that tooth loss could reflect "lifelong socioeconomic disadvantages, such as limited access to and quality of medical and dental care, fewer years of education, and poor nutrition." "Income and education are very much related to oral health, probably even more so than many other chronic conditions, particularly because of the lack of dental insurance for many people," Wu said. Wu added that these oral health disparities are especially prominent in the United States, where the health care system is complicated to navigate, and many people do not have access to dental care as part of their health insurance or are required to pay dental expenses out-of-pocket. She said the analysis should serve as a reminder – to both governments and everyday people – of the importance of maintaining good oral health from an early age all the way through to adulthood. The American Dental Association and the AAP also say that preventive care and regular dental checkups are important to protect teeth from cavities and guard against gum disease. "Gum disease is preventable with daily tooth brushing and flossing and routine visits to a dental health professional," Wilson added. "Patients should also expect to receive a comprehensive periodontal evaluation on an annual basis."

-Source-

CNN Health, July 8, 2021

Answer Sheet I

Subject English

Exam No. _____ Name _____

Question I.

1. Give the appropriate title of this article (10%).

2. Describe what organ was used for evaluation (10%).

3. Describe the problems with conventional non-adhesive implants (10%).

4. Summarize this paper in 100 to 200 words (20%).

Answer Sheet II

Subject English

Exam No. _____ Name _____

Question II.

1. What diseases do adults with a lot of missing teeth suffer from and how high is that risk? (10%)

2. What are the benefits that dentures bring to patients? (10%)

3. Describe the relationship between poor mouth health and poor brain health. (10%)

4. What can the tooth loss indicate? (5%)

5. Why are oral health gaps distinct in the United States? (10%)

6. What is the important to prevent the periodontal disease? (5%)