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REVIEW ARTICLE

ORIGAMI IN MEDICAL FIELD: A REVIEW ARTICLE

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ABSTRACT

Origami or Japanese paper folding had been invented hundreds of years ago. Initially for entertaining purposes such as making models and toys. As the time pass by people have found ways to use origami in mathematics, science, education and medical field. Origami can be use in medical purposes such as stent, stomach wounds patching robot, concentration span in autistic children and lower stress in traumatized children. And the use of origami in medical field seems to be increasing constantly as the time pass by.

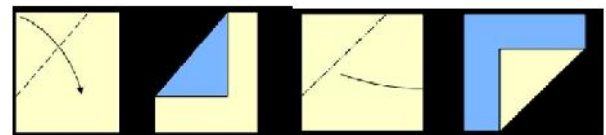
INTRODUCTION

Origami was invented in Japan mainly for entertainment for examples, making models such as, crane, fish, ships etc. Later on, origami also beneficial in science and engineering field such as, studying the closing and blooming of flowers even the designing of foldable solar panel for the satellite. This past 10 years origami had been used in medical field diversely whether medical engineering, surgery and psychological therapy.

Origami: Origami means paper folding in Japanese which had shown the sign of creativity and complexity (Fei, 2013) There are models that origami can do such as, geometrical shapes, toys and animals which are simple and easy for children to follow (Araki, 2002) There are 2 basics sign in origami diagram which are dots and dots with dash lines and in the origami ways we call it valley fold and mountain fold respectively (Robinson, 2004; Lang, 1988; Miyashita, 20154)

Valley fold: the tip of the paper will headed-down making it looks like a valley

Mountain fold: the tip of the paper will headed-up making it looks like a mountain



Valley fold Mountain fold

Origami Robot for Patching Stomach Wounds: There is a project for micro-robots that is able to go into human digestive tract to heal wounds. The micro-origami robot is capable of penetrating into the digestive tract with the help of technology the robot is able to capturing pictures, use advance wireless control and self-decompose without creating harmful substances (Miyashita, 2015). The robot was designed to be ingested through the esophagus into the stomach (fig. 1). In the stomach the robot will be automatically activated and is control via magnetic field to guide the robot to the wounds. After they arrived at the wounds, the robot will patch itself to the wounds and self-decompose releasing the drug inside. Origami is perfectly suitable for designing the robot because the robot requires mobility and compact design to ease the ingestion. There are reports that more than 3500 people have ingested button batteries in United States and the numbers in constantly increasing. The report said that there are 46 deaths and 183 people who had severe burn in the digestive tract and some complications in the past 40 years and most of the victims are children. And this is where the robot are going to be come useful because not only it can get rid of the battery but also it is able to decompose itself after usage (Miyashita, 2016).

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Whereas the idea has not been made yet it is an extremely interesting technology and will revolutionize the digestive technology field. Moreover, the robot can be further develop to go into the blood vessels by shrinking the design of the robot.

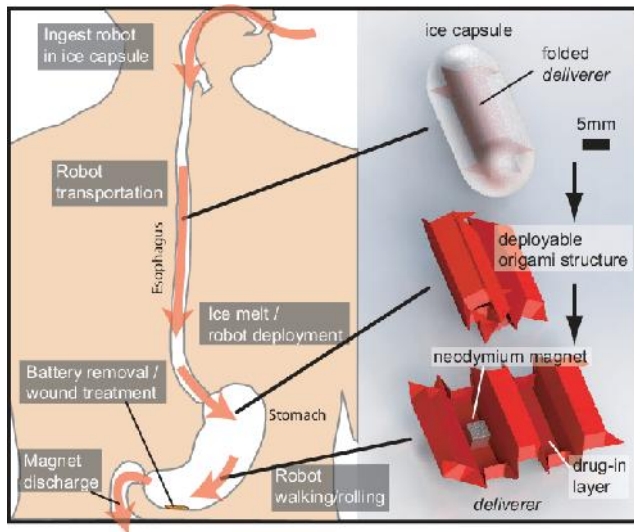


Fig. 1. The developed system. An iced robot is transported into an artificial stomach. Once the ice melts and the robot is deployed, the robot is controlled using a remote magnetic field. The robot removes a foreign body, such as a button battery, from the location and further treats an inflammation by delivering a drug.

Origami Stent: Vasodilation via vasodilation stent is the process to put out the blood flow blocking fats in the blood vessel away from the blood flow trail what is the result of atherosclerosis. Furthermore, the stent can be use in curing coronary artery stenosis and esophageal cancer. The problem with the ordinary stent is the fats and blood clot are able to clog the nets of the stent. (Edelman, 1996; Gottsauner, 1996) Stent is further developed to effectively prevent osteoporosis in organ transplant. Anyway, there can be problem with the net breakdown due to geometrical design (Chuter, 2002; Jacobs, 2003).

Stent with Balloon Angioplasty

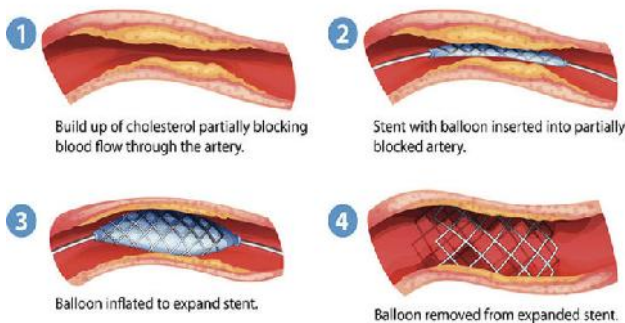


Fig.2 Current stent

Fig. 3 (a and b) show the photographs of one of the new stent graft designs made from a single sheet of card in its fully folded and deployed configurations, respectively. The folding of the new stent graft is achieved by dividing a cylindrical tube into a series of identical elements with hill and valley folds as in origami. Fig. 2(c) shows the pattern of folds. The solid and broken lines represent hill and valley creases, respectively.

The folds act as hinges when the stent graft is folded. (Kuribayashi, 2016).3 advantages of stent origami are 1. More strength 2. No blood clot and fats between the nets3. Compact design and able to transform into a smaller form.

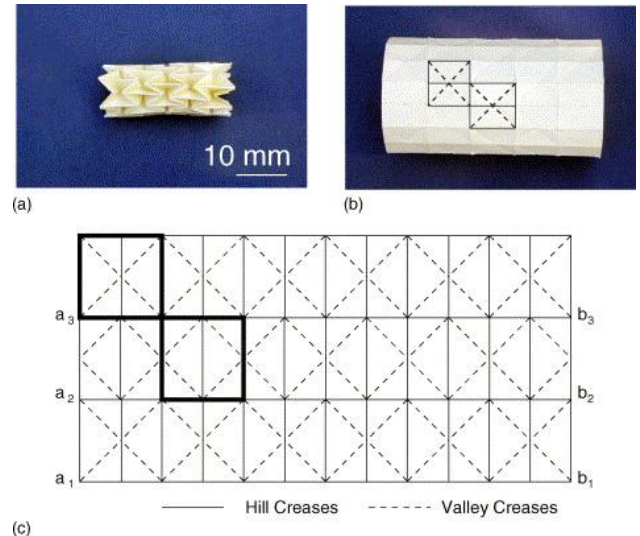


Fig3. Photographs of a card model of the origami stent graft in its (a) fully folded, (b) deployed configurations and (c) deployment of the folding pattern. The opposite edge of a sheet, a1-a2-a3 and b1-b2-b3 are joined together to form a cylindrical tube.



Fig4. Models of an origami stent graft that can be used in the treatment of esophageal cancer. The models are made from stainless steel tubes to obtain good geometrical compatibility during expansion, though in reality much more flexible materials are used.

Eventhough origami stent has not been officially confirmed safe. It is a very useful research that would be very beneficial to the medical field.

Effectiveness of origami on hospitalized anxiety among children:

The research from Smiling Hospital Foundation in Hungary, an art therapist at the Smiling Hospital randomly select 24 children who are the patients in the hospital and let the children enjoy 30 minutes of magic shows, music, story telling, puppet and handcraft. After that, do the blood test and look for the lymphocytes and cytokines Th1/Th2. From the study, the result suggested that the concentration of a child is directly proportional to the strength of their immune system (Beres, 2011). The research paper about play therapy in a hospital in Sweden is about the program that the researchers

will give children opportunity to use expressive arts such as, clay, paint, craft and textile for 3 years. After that the study was conducted those children were randomly surveyed. According to the research, the study have found that children lessen their expression on emotional pain by crying, sleeplessness or decreased communication (Wikstorm, 2005). The emotional pain such as, depression and anxiety in children tend to be lessen when they are doing origami because origami help those children focus, increase their creativity and forget about the pain. Moreover, it also brings joy to the children, develop their thinking skill and thought process via doing origami. Therefore, origami should be use in psychological therapy and it would play a crucial role in mental recovery (Mathew)

Improving child with Autism, Attention deficit disorder(ADD) and Learning disorder (LD): According to the research, origami can enhance children with autism's skill in many different ways which are Improve attention span and concentration, explicit instruction and sequential learning, relive stress, improve memory and organization skills, improve cognitive processing, provide positive learning experiences and relive boredom (Swanson, 1999; Rogers, 1969; Gardner, 1993)

Conclusion

Usage of origami in medical field is divided into 2 main types. The first type is physical curing which merge the origami techniques with medical engineering to design gadgets and medical tools for example, vasodilation stent and stomach patching robots. The second type is mentally curing which base on relieving the patient with origami and also develop concentration skills on children with autism. Even though, origami is very useful and beneficial in medical field the use of origami overall is still small. These researches and methods have only been carried out by some doctors and researchers and it is also difficult and challenging to make use of the origami in the medical field effectively.

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