International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 1 Issue 6, August - 2012

Design and Analysis of New Forceps for Robot Assisted Surgical Operation

[1]Ebinezaru Babu Gollamudi , [2]Tippa Bhima Sankara Rao

[1] M.Tech, Machine Design, Department of Mechanical Engineering, Nimra Institute of Science & Technology,Vijayawada,Andhra Pradesh ,India
[2] Professor, Department of Mechanical Engineering, Nimra Institute of Science & Technology,Vijayawada,Andhra Pradesh ,India

***Abstract-* The robot assisted surgical operation that has both safety and effectiveness. The safety and effectiveness of the operation is also depends upon the force that can apply by the forceps on any organs. So the research and development of the forceps is needed in consideration of the physical, mental strain decrease of the surgeon and the patient.**

As by this observation I developed and proposed the flexible new forceps for robot assisted the surgical operation.

Keyword-Conventional Forceps, New Forceps, New Forceps with two flanges.

1. Introduction:

Robotics is now being used in all surgical fields, including general surgery. By increasing intra-abdominal articulations while operating through small incisions, robotics are increasingly being used for a large number of visceral and solid organ operations, including those for the gallbladder, esophagus, stomach, intestines, colon, and rectum as well as for the endocrine organs.

Robotic surgery utilizes the most advanced technology allowing surgeons to perform complex procedures that may not be feasible through laparoscopic or endoscopic procedures.

Especially, for surgical operation, the technology can decrease physical and mental strain of the surgeon and the patient. So it is necessary to research and develop the forceps that are used in surgical operations for both safety and effectiveness.

2. Types of Surgical Forceps:

Surgeons use several types of forceps for different tasks. Some of these forceps lock in the closed position, while others do not. Forceps may also be made from different materials, including metal and plastic.

2.1 Conventional forceps:

The Conventional forceps are hinged instruments with handles that are similar in design to scissors except that the cutting blades are replaced with an end that is made for securely holding objects. As shown in Figure 1, the conventional forceps are grasping at anything with two stainless steel plates which have a bulge in the center. It is ease to focus on specific portions of the internal organ. Conventional forceps vary greatly in size and design.

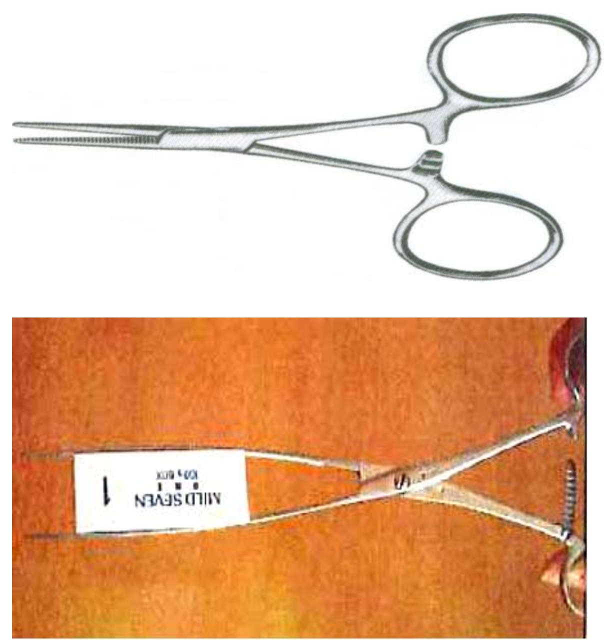

Figure: 1 Conventional forceps

When the blood pressure rises, increase the holding pressure to prevent the content leaking, when the blood pressure descends, decrease the holding pressure to decrease the load of the organization and internal organs. But the changes of holding pressure not a possible when holding the small intestine tube by the conventional forceps. Because of this reason increase the strain on Patient as well as Surgeon.

2.2 New Forceps:

The pressure in small intestines was 0.53×105Pa (40mmHg) or more (about 544mmH2O) i.e., the experiment poured water from the place of 550mm in height in small intestines.

The prototype gripper of the new forceps robot was modeled as shown in Figure2. The material of forceps is SUS304 and the main characteristic of small intestine is shown in TABLE.

SUS304 MECHANICAL PROPERTIES:

Density (kg/m^3) 8000
Tensile Strength (Mpa) 520
Yield Strength (Mpa) 240
Poisson's ratio 0.27-0.30
Brinell Hardness (HB) 88

Properties / **Materials**	***Young's modulus E [MPa]***	***Poisson's ratio σ***
Sus304	1.9×10^5	0.285
Small intestine	3.16	0.475

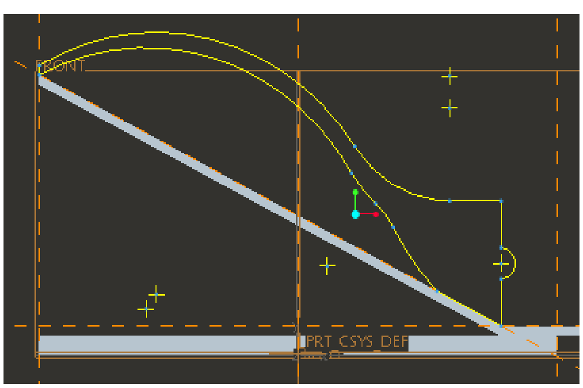

Figure: 2.New forceps prototype model

2.3 Comparison of results in New Forceps with Conventional Forceps:

The development of the Conventional and New Forceps by the method of the finite element, the above two forceps were modeled and analyzed. The obtained results are shown in figure 3 and figure 4.

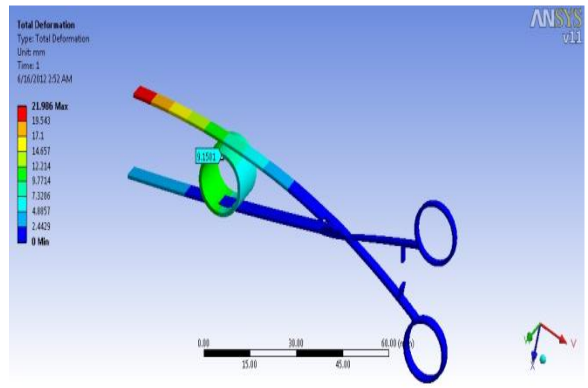

Figure 3.Total deformation in Conventional forceps.

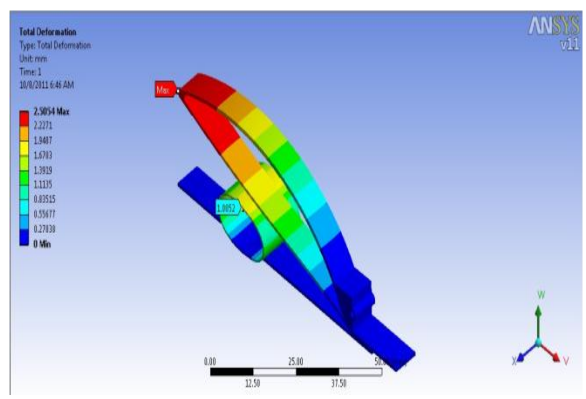

Figure 4.Total deformation in New forceps

From the analysis of above two types of forceps, the authors finalized that under holding force 30 N, the maximum deformation occurs in Conventional Forceps than the New Forceps.

3.Development of New Forceps with Two Flanges for surgical Operation:

The prototype gripper of the new forceps with two flanges robot was modeled as shown in Figure5.

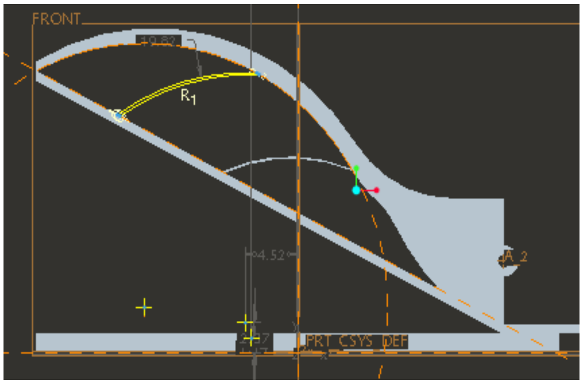

Figure 5. New forceps with two flanges model

3.1 Comparison of results in New forceps with two flanges and New forceps:

The development of the forceps robot by the method of the finite element, the New forceps with and without two flanges forceps were modeled and analyzed. The obtained results are shown in figure 6 , figure 7 and figure 8.

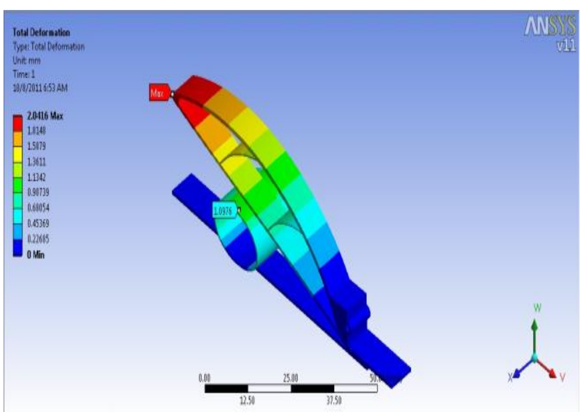

Figure 6. Total deformation in New forceps with two flanges

From the analysis of above two types of forceps, i.e., New Forceps with and without flanges the authors finalized that under holding force 30 N, the maximum deformation occurs in New Forceps without flanges than the New Forceps with flanges.

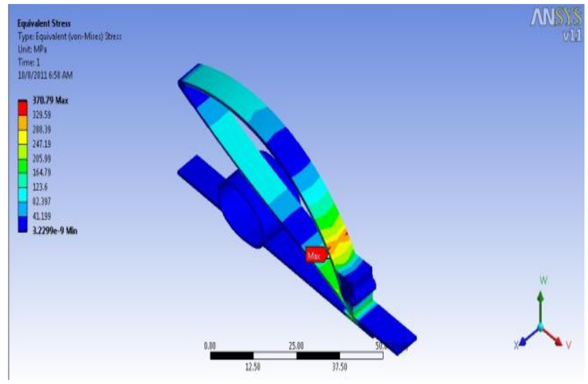

Figure 7.Equivalent stress in New forceps

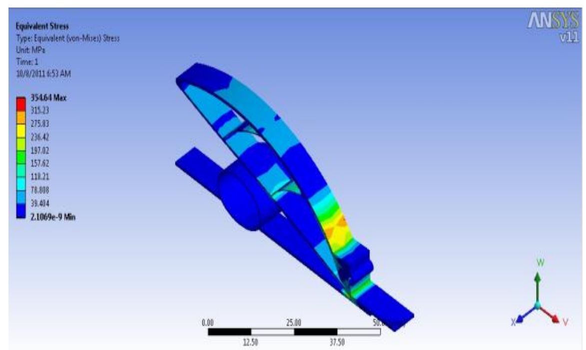

Figure 8.Equivalent stress in New forceps with two flanges.

By comparison of New Forces with and without flanges in New forceps with two flanges occurs minimum equivalent stresses than New Forceps without flanges.

4. Conclusion

From the analysis the authors can finalized the following results. The holding force was smallest in the middle of holding part of the each three types of the Forceps. By comparison of results analysis the smallest equivalent stresses developed in New Forceps with two flanges.

According to the finite element method analysis, like the New forceps with two flanges as shown in Figure 6 and Figure 8, it is possible to hold for making the power distribution average and wrapping soft internal organs. Power can be concentrated on the hand tip, and it is not necessary to powerfully hold and pull out.

ISSN: 2278-0181
Vol. 1 Issue 6, August - 2012

REFERENCES:

[1] Yamamoto, I., Marine Control Systems, International Journal of Robust and Nonlinear Control, IFAC, vol. 11, no. 13, Wiley, 2001

[2] Madeen, E., Doctor Robopet, ANA Wingspan, no.416, pp 24-29, 2004.

[3] JSME：Technology samples Modulus of Elasticity of Metals p.99

[4] refer www.meadinfo.org

[5] Text book of Endourology by Arthur and D.Smith.

[6] Oppenheimer MJ, Mann FC： Intestinal capillary Circulation during distention. Surgery 13：548—554, 19743

[7] Biomechanical simulation Physical properties value Data Base Japan Shizuoka Prefectural Industrial Technology Research Institute : http://cfd-duo.riken.go.jp/cbms-mp/