SSQX/ZL/2021041031

Comparative experimental report of different brands of Lap grasper

I Experimental Aim

In order to evaluate the grasping pliers in the endoscopic products, find out the problems and weaknesses of our own products, learn the advantages of other manufacturers and improve them, according to the industry standards of grasping pliers and the clinical feedback of products, conduct a number of horizontal comparative experiments of performance, improve the performance of products and improve the quality of products. This comparison is made on the basis of the last comparison, adding new comparison terms.

a) Experimental design

b) Samples

Brand	SHINVA	Ackermann	STORZ	Wolf
Qty/Pc	1	1	1	1

c) Experimental content

NO.	Name of test	Operation content	Equipment
1	**Appearance of the contrast**	Visual appearance, except for special purposes, to see whether the external surface has burrs and other defects that could cause injury	Quality engineer visual inspection
2	**Head end reflection**	Light source in different directions illuminates the head to see if there is directional reflection	Quality engineer visual inspection
3	**Working length**	The steel plate ruler measures the maximum length of the grip insert	Steel ruler
4	**Maximum width of insert part**	Calipers measure the maximum width of the insert	calipers
5	**Maximum opening of the clamp head**	Universal Angle ruler to measure the maximum opening range of the pliers head	universal angle meter
6	**Tong head tooth profile**	The shape and closure of the tongs were observed with a microscope	Microscopic magnifying glass

7	**Opening and closing performance of grasping pliers**	Whether there is rotation or shaking of the clamp head in the process of use; Open and close the process to keep smooth, not to affect the use of astringency and shaking	Quality engineer hand test
8	**weight**	The scale is used to measure the overall weight of the grip	Scale dial
9	**Ease of disassembly and installation**	Disassembly and assembly experiments were carried out for different grasping forceps	Quality engineer test by hand
10	**Experiment of gripping force**	The 7# suture was used as the experimental material, and the suture was clamped with the forceps head and dragged with force, and the tension value of the suture sliding was recorded	Tension gauge, 7# sutures
11	**Test for elasticity and firmness**	Make the meshing force of the pliers head between 17-18N, bite 2mm steel wire at room temperature and keep it for 3h, release the pliers head and take photos	φ2 steel wire, tension meter
12	**verticity**	Whether there is a stutter or wobble when turning the wheel	Quality engineer test by hand
13	**Closed resultant force transfer coefficient**	The transfer coefficient of closing force was tested by special tooling	Force transfer coefficient test tooling
14	**electrical conductivity**	A multimeter measures electrical conductivity	volometer
15	**leakproofness**	Expansion chamber pressure device 4Kpa to grasp the clamp inflation, the number of bubbles out of a minute number	Timer, expander pressure device
16	**corrosion resistance**	After disassembly, place in the boiling pot, the immersion height should be greater than 30mm, heat to 100℃, hold for 30min, cool naturally to room temperature and then keep for 1.5h, remove the product from the test water and expose it to the air for 2h, observe the surface and take photos to record	Bring to a boil with a magnifying glass
17	**High temperature autoclaving experiment**	The non-woven cloth was wrapped in the sterilization box and put into the sterilization cabinet. The sterilization temperature was 134℃, the sterilization time was 600s, the drying time was 900s, and the cycle was 20 times. The surface state was observed, the tube length was measured and recorded	High temperature and high pressure sterilization cabinet, calipers, microscope magnifier

c) Test date

March 8, 2021 to April 5, 2021, reporting date: April 8, 2021.

III. Test result

1) Appearance of the contrast

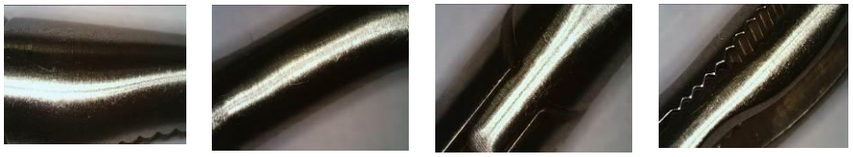
Visually compare the products of the above four brands (see the following picture)

There are no burrs or other defects that may cause injury on the external surface of the products of the four brands. Overall s tructure, Wolf brand and Ackermann products have no flushing interface components.

2),Head end reflection

Different directions of light source irradiation head, under the microscope to observe the head reflection:

Brand	SHINVA	Ackermann	STORZ	Wolf



Because the tongs are made of metal material, the reflection of light is inevitable due to the low surface roughness.

3). **Working length**

Use a steel plate ruler to measure the maximum length of the grip insert

Brand	SHINVA	Ackermann	STORZ	Wolf
L/mm	305	322	320	333
Relative SHINVA length	0	+17	+15	+20
Long to short ranking	4	2	3	1

4) **Maximum width of insert part**

When measuring the maximum width of the inserted part of the grip using calipers with a meter, measure the width of each part perpendicular to the

insertion direction and obtain the maximum value

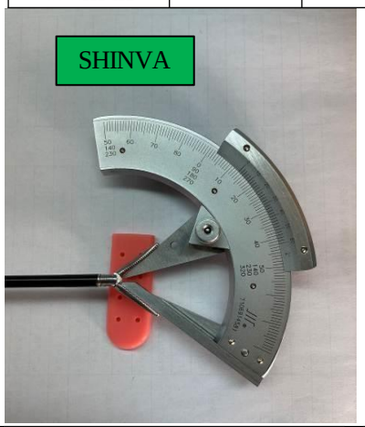
Brand	SHINVA	Ackermann	STORZ	Wolf
D/mm	5.1	5	4.8	5
Relative SHINVA width	0	-0.1	-0.3	-0.1
Wide to narrow ranking	1	2	4	2

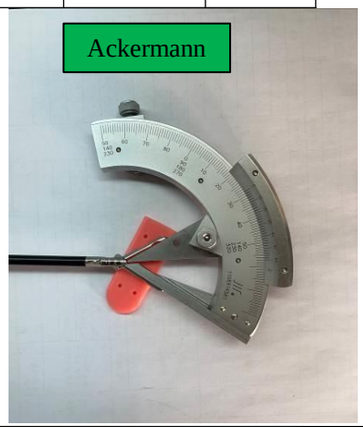
In addition to Xinhua products, the maximum width of the inserted part of the claw of other brands is not more than 5mm, and the width of the Xinhua product is 5.1mm for the insulated outer tube head (PEEK tube has a reinforced thin-walled tube); The narrowest is the STORZ product, which has the smallest overall shape among the seven brands.

5），**Maximum opening of the clamp head**

Universal Angle ruler was used to measure the maximum opening of the clamp head

Brand	SHINVA	Ackermann	STORZ	Wolf
θ/°	77	78	52（single open）	70
Compare with SHINVA angle	0	+1	/	-7
From big to small	2	1	-	4

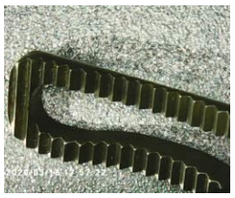




The opening Angle of SHINVA and Ackermann is larger, 6-15° larger than that of other brands, which can meet more use needs and capture larger tissues and lesions.

6)Tong head tooth profile

The shape and closure of the tongs were observed with a microscope

Brand	SHINVA	Ackermann	STORZ	Wolf
OPEN				
CLOSE				

SHINVA teeth are comparable to Germany brands in both surface and shape

SHINVA clamp head closure is **relatively neat**, comparable to Germany products.

7), Opening and closing performance of the grip

In the open state, the head of Ackermann's grip pliers can shake slightly, and the core rod of other brands has slight rotation (twist). When the clamp is closed, the head position of the four Brand products **does not shake**, and the opening and closing feel is good.

The shaking of Ackermann's clamp head is because there is a movable gap in its hinge structure, which fixes the core rod.

8). Weight

Use a scale to weigh 4 kinds of products

Brand	SHINVA	Ackermann	STORZ	Wolf
M/g	94	118	78	125
Compare with SHINVA weight	0	+24	-16	+31
Heavy to light ranking	6	2	7	1

SHINVA

Ackermann

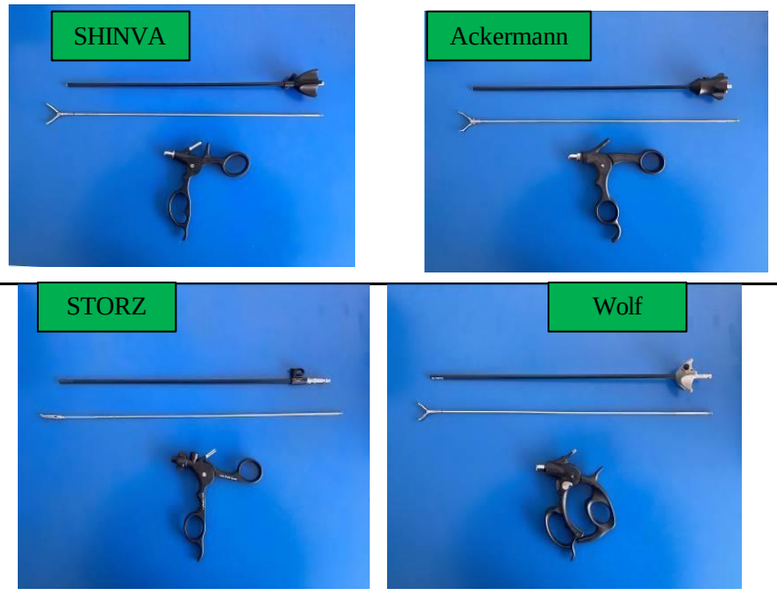
STORZ

Wolf

Ackermann and Wolf products weigh 18-47g heavier than other brands due to their wide handle structure design. STORZ products because of its runner and handle design are relatively small, according to the characteristics of Chinese people have been specially designed, the weight is as low as 78g, long time use is more labor-saving; **SHINVA weighs 94 grams, which has some advantages over other products.**

9), **Ease of disassembly and installation**

The disassembly and installation experiments of four Brand products were conducted to compare the disassembly and installation degree. A video was recorded during the test. The picture below is the picture after disassembly



All brands are three disassembly, all brands only need to choose the direction of disassembly can be, easy to learn; **SHINVA product disassembly feel better.**

10 ， Experiment of gripping force

Test the gripping force with the 7# suture to see if the suture can be pulled with a 20N pull. The results showed that SHINVA, Ackermann, STORZ, and Wolf grasp forceps **could keep the sutures under 20N tension**

11 ， Test for elasticity and firmness

At room temperature, after holding 2mm steel wire for 3 hours, no deformation or cracking occurred in the grip heads of all br ands, and no microcracks were found under the microscope, indicating that the comprehensive mechanical properties of the gr ip heads of all brands were excellent.

STORZ/Wolf/Ackermann/SHINVA

12),**Verticity**

Manual wheel rotation test was performed on 4 Brand grip pliers

Brand	SHINVA	Ackermann	STORZ	Wolf
Rotating feel from light to heavy ordering	1	3	4	2
Whether the rod shakes	NO	NO	NO	NO

The new product is very light to the touch. **Other Brand feel is not as easy as SHINVA**, there is a certain astringent feeling.

No shaking of the rod was found in the four products.

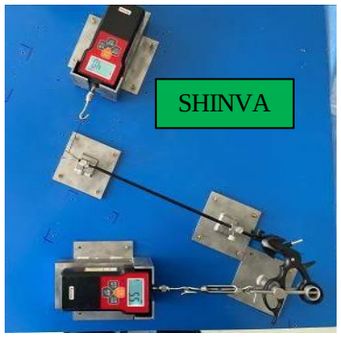
13), **Electrical conductivity**

A multimeter was used to test the electrical conductivity of each Brand grip, and the electrical conductivity of each Brand instrument was good.

14), **Closed resultant force transfer coefficient**

The closed force transfer coefficient test tool was used to test different brands of grip pliers. Since the handle of Wolf and Ackermann products was not suitable, the tool could not be used, so this experiment did not test these two products. Other Brand test results are the mean values calculated by the least square method after multiple measurements

Brand	SHINVA	Ackermann	STORZ	Wolf
Closed resultant force transfer coefficient	0.7	-	0.52	-



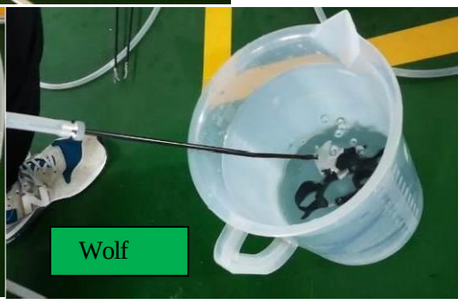
The results showed that the force transfer coefficient of SHINVA was higher among the four products

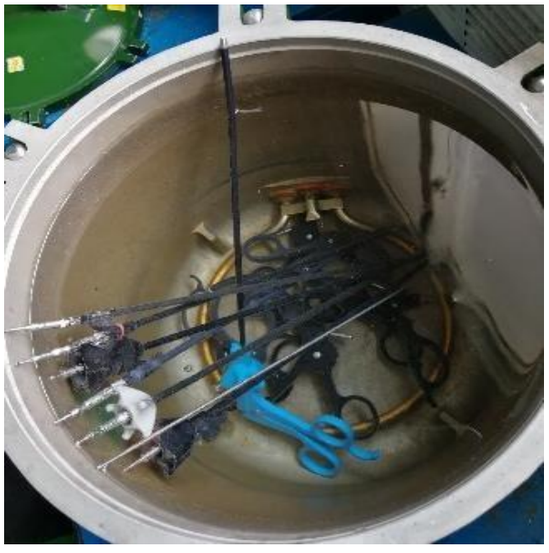
15）,**Adjust the pressure of the expansion chamber pressurizer to 4kPa**, **connect the tube to the clamp head, time for one minute,** and record the number of bubbling.

Brand	SHINV A	Ackerman	STORZ	Wolf
Bubble	12	/	＞60	＞60

16), Corrosion resistance

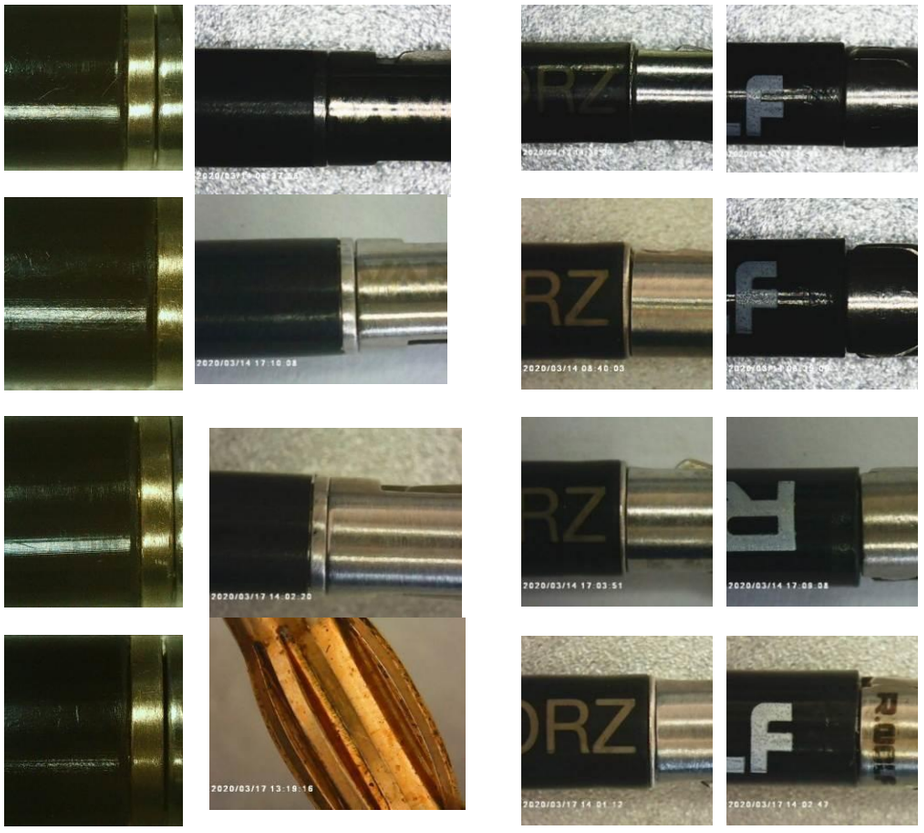
After disassembly, the product should be placed in a boiling pot, the immersion height should be greater than 30mm, heated to 100 ° C, held for 30min, cooled naturally to room temperature and then kept for 1.5h. The product was removed from the test water and exposed to the air for 2h, and the surface was observed and photographed. Microscope magnifying glass to observe whether the surface is rusty.





There is no surface corrosion, crack and other defects in the above four grasping pliers, indicating that the materials of each Brand and SHINVA grasping pliers are properly selected, and after sterilization according to the standard requirements, **there will be no rust and micro cracks in the grasping pliers after operation**.

17), **High temperature autoclaving experiment**



IV. **Compare each grip after 20 times of sterilization:**

1. **There is no change in SHINVA grip, the function is still intact, and the feel is unchanged**

2. After 20 times of sterilization by Ackermann grasp pliers, the electrode is rusted and can't be wiped off. There is no expansion of the outer sleeve and no change in feel

3. STORZ and Wolf grasp pliers have no change, the function is still intact, and the feel is unchanged

v. Experimental conclusion

To sum up, after comparing the different performance of four different brands of grip pliers horizontally, it can be concluded that: Present SHINVA catch clamp pliers head tooth shape, tong head open largest amplitude, opening and closing performance, weight, degree of difficulty, dismantling, clamping force, flexibility and robustness, rotating performance, closing force transfer coefficient, electrical conductivity, sealing, corrosion resistance, resistance to high temperature and high pressure sterilization, compared with other domestic products have certain advantages, gap control and detail is better, STORZ does a great job with weight control.