A new device for sutureless skin closure "The Zipper"

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Abstract

Background: *We have done a prospective, controlled, randomized study to investigate the role of the "zipper", a new device for skin closure. We have also analysed morbility and advantages with the use of the "zipper" compared with sutures.*
Methods: *610 consecutive patients underwent surgery for abdominal thoracic endocrinologic and post traumatic pathologies. In 203 cases we used the zipper a new device for skin closure.*
Results: *6/203 Morbility: in six cases it was necessary to substitute the zipper with sutures or leave the wound healing by second intention. The patients were operated for inguinal hernioplasty, axillarylimphadenectomy,appendicectomy and cholecistectomy. These patients developed complications after surgery as hematoma, lymphorrhea,wound infection and a reintervention.*
The correction has been done removing the zipper and positioning sutures or leaving the wound healing by second intention.
Conclusions: *The use of the zipper permits to achieve an efficent seal, a simple application, an aesthetic comfort; it can be applied in local anaesthesia and for its painless, application it is indicated in pediatric surgery.*
Key words: Surgical zipper, skin closure.

Riassunto

Gli Autori presentano la loro esperienza sulla sintesi atraumatica delle ferite chirurgiche utilizzando una cerniera che consente la sintesi della cute senza applicazioni di punti di sutura. Descrivono le caratteristiche tecniche della cerniera, la metodica di applicazione,ne illustrano i vantaggi e svantaggi ed infine analizzano i risultati clinici fino ad oggi ottenuti.
Parole chiave: Chiusura ferita chirurgica.

Introduction

The conclusive moment of all surgical operations is represented by the cutaneous syntesis that is a very important act (1, 2, 3, 4, 5, 6, 7, 8).
In fact the realization of an efficent cutaneous healing process depends on many factors such as the relative contamination of the subcutaneous tissue, the reduced trauma of skin flaps, the type of suture material used and the way the suturing is done (7, 8, 9, 10).
Moreover the realization of a surgical scar aestheticaly acceptable, is very important for the patients.
The tecnological progress has contributed to the development and the perfection of new and selective methods such as the introduction of disposable skin sutures, that have improved significantly the healing process, and the aesthetical view of the surgical wound (7, 8, 11, 12).
Some years ago Kaessman et Al (1989) in Germany developed a new method for the not traumatic synthesis of superficial wounds.
It consists in a zipper that makes possible the skin synthesis without applying any type of stitches (13, 15, 16, 17, 18, 19, 21, 22, 23, 24).
The aim of our study was to control the efficiency of the zipper and compare it with sutures and agraphes for cutaneous synthesis of 610 patients that underwent surgery, abdominal, thoracic, endocrinological and post-traumatic pathologies.

Patients and methods

From September 1994 up to December 1999 in the Institute of General Surgery at the University of Ferrara, a number of 610 patients were recruited: in 203 was used the "zipper", a new method of cutaneous synthesis

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(134 were female and 69 were male); in 202 patients were used sutures (120 were female and 82 male) and in 205 patients were used staplers (112 were female and 93 were male). Almost all underwent surgery with total anaesthesia and only 59 with partial anesthesia and in these we used only the zipper. The three groups of patients were treated in the same way, not only in the phase of preparation for the surgery, during the surgery and after the surgery. The preparation for the surgery requires an accurate cleaning and disinfecting of the skin: the afternoon before a shower is done with clorexidana 4% the skin area should be shaved 3 hours before the surgery the disinfection of the operating area is done with a solution of isopropanololo and polivinilpirolidone, while the edge of the wound are protected with the necessary gauze or steril rings.

At the end of the surgery, during the wound synthesis it is provided the constant washing of the subcutaneous tissue and once again disinfection of the skin. The sutures were of silk "0" or "2-0", while the skin stapler is available in three types from 15-25-35 span staples.

The "zipper" used comes in a single steril package and it is available in size from 4 cm to a maximum of 50 cm; the choice must be made bearning in mind that the length of the zipper must be longer of 2 cm on each side of the wound.

The zippers were applied on all the patients studied regardless of the type of surgery or the type of anaesthesia that was used (Tab. I). The sutures and staplers were applied only under total anesthesia.

First of all before the surgery, the skin area where the incision will be made should be adequately shaved paying attention not to provoke lesion from incision that are able to cause infections that could challenge the good functioning of the zipper.

Therefore a thorough synthesis of the lower layers in particular of the subcutaneous ones must be done, to obtain the perfect fitting of the cutaneous borders.

After having well cleaned and scoured with an alcoholic solution on each side of the surgical incision the surgical zipper may be applied.

Tab. I – ZIP APPLICATION SITE

Incision	*Numbers cases*
Thoracostomy	13
Inguinal incision	49
Mc Burney	30
Pfannestey	14
Stewart incision	18
cervicotomy	10
Pararectal incision	12
Midabdominal line incision	33
Subcostal line incision	16
Post-traumatic wound of the limb lower & upper extremity	8
Total	203

The device consists of a zipper between two adhesive sticks of Polyamide (hypoallergic and transpiring material) provided with holes to ventilate and drain the wound; at the head of the two stripes there is an elastic band which is necessary to obtain the proper tension of the zipper.

The surgical zipper has to be opened and applied at a distance of about 0,5 cm from the wellfitted edges of the wound, promoting with a light pressure the adhesion of the side adhesive bands. In this way it is possible to close the zipper keeping in tension with a hand the band at the head of it making the cursor slide slightly lifting it (Fig. 1-2-3-4). After the surgery the first medication is done on the third day when it is possible to open the zipper to evaluate the fitting grade of the cutaneous marging and the cleaning of the wound. The zipper is changed every time the wound or the zipper are too dirty and it is removed from the 7^{th} or the 9^{th} day after the surgery when the wound is completely healed. The sutures and staplers are removed in two different times partially on the 7^{th} day and totaly on the 9^{th} and 11^{th} day using a scissor for the traditional sutu-

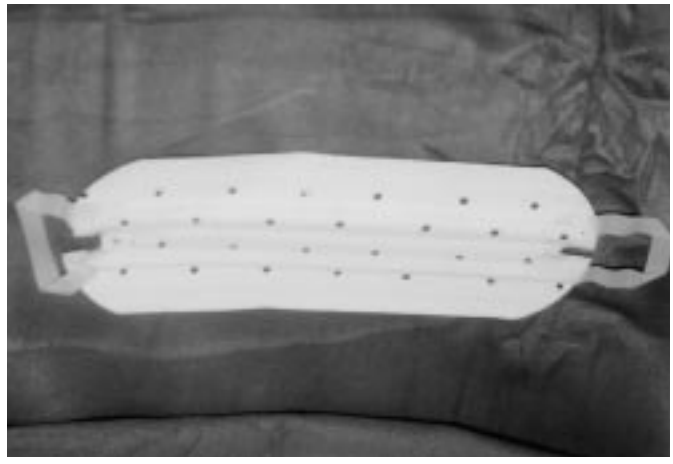

Fig. 1: Removal of the two adhesive sticks.

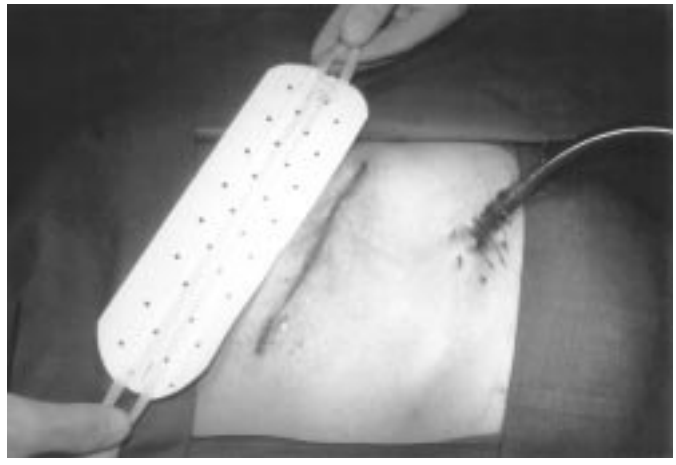

Fig. 2: opening of the zipper.

Fig. 3: Application of the zipper.

Fig. 4: Zip fastener.

re thread and the right forceps for the metalic stitches. The discharge has been made according to the case for which the patient was operated, therefore the situation was not changed with the use of the zipper, in comparison with the use of suture stitches and of skin staplers.

Results

The experience acquired up to now and the result obtained in using this new surgical device is without a doubt satisfactory. The zipper was not used in cases where there were complications such as dehiscence intestinal anastomosis or when the surgery was considered contaminated or when the cutaneous suture would have likely been the cause of a major risk of infection. The use of skin staplers is absolutely controindicated in patients in which we carry out large demolition of the muscular tissues and subcutaneous for which it becomes difficult to put side by side the cutaneous edges, therefore preventing the redevelopment layer by layer of the abdominal wall.

Tab. II – DESCRIPTION OF THE COMPLICATIONS USING "ZIPPER" AND THEIR CORRECTION

Surgery	*Complitation*	*Correction*
Inguinal Hernioplasty	Hematoma	Suture stitches
Inguinal-scrotal Herniopl	Hematoma	Suture stiches
Axillarylymphadenoctomy	Lymphorrhea	Suture stitches
Appendicectomy (2)	Wound infection	Healing by second intention
Cholecystectomy	Reintervention	Suture stitches

The presence of aedema and/or rash, the scaring grade and eventual presence of the upper fascia infection has been evaluated in all the patients that were included in the study. All the patients where evaluated immediately after the operation and also after 30, 60, 180 days and one year.

At the beginning of the clinical study some patient complaint psychological discomfort from fear that the zipper would not hold, this problem was interpreted as fear of an unusuale situation. In fact as soon as information on this new surgigal device was explained we didn't have any more psychological sensation of discomfort. In our study we had 16 cases of which we had to substitute the zipper or with another zipper (10 pz) or with stiches (6 pz).

In six cases it was necessary to substitute the zipper with suture stitches (Tab. II).

This happened for two patient; one operated for inguinal hernia and one for inguinal-scrotal hernia; for patient operate for mastectomy and lymphadenectomy on the same side; for two patient operated on appendicoctomy and for a patient operated for a cholocystectomy. In the first two cases the complication was, subcutaneous hematoma and we had to remove the zipper and place suture stitches.

In the third case the patient operated in the breast developed on the fourth day after surgery an abundance lymphorrhea that made it necessary the removal of the zipper and placing suture stitches.

In the two cases of acute appendicitis we had to remove the zipper on the third and fourth day the other due to an infection of upper fascia and we let the wound heal by second intention.

In the 1st case it was necessary to operate again due to complications, in fact the patient was operated for a cholecystectomy because his cholecyst was hydropic, and after surgery he developed an effusion of gall caused by an accessory biliary duct and we had to remove the zipper and place sutures. The zipper has been substituted in other 10 cases without the necessity of another operation. It became necessary to substitute the zipper bocause it was too dirty or because it detached due to the excesive sweat of the patients; also in this cases the substitution of a new zipper didn't contributed to change the healing process.

Discussion and conclusions

In a previous study it was already demonstrated the advantages of the skin staplers in comparison with sutures stitches (1, 3). The advantages of using the zipper are many. First the non traumatic synthesis of the surgical wound has obtained unquestionable benefits.
The zipper is of simple and rapid use, easily applicable, and not requiring the use of other surgical instruments (6, 10, 19, 20).
We can remove the zipper without pain and with great relief for the patient (14, 21). The removal of the stitches whether being thread of "agraphes" represents always a troublesome period and some times painful for the patient.
We can use the zipper directly in first aid or in the out patient's department for the synthesis of the superficial wound making it possible avoiding local anesthetic.
The result both esthetic and functional are remarkable: the patient even after the first check-up after the surgery have demonstrated great satisfaction for the esthetic results achieved, above all those who doubted the efficiency of the zipper (14, 21).
The sticker situated below has resulted safe: it has always becn well tolerated by the skin assuring a perfect seal since it is hypoallergic and microporous.
In our study we had 16 cases of which we had to substitute the zipper or with another zipper (10 pz) or with sutures (6 pz).
There have not been registered technical inconveniences during the phase of opening and closing of the zipper. The high tolerability and the painless application make the use of it particularly indicated in the pediatric surgery.
The functional results are encouraging: the healing process has always occured in the predicted ways and time; the absence of even the most simple cutaneous traumatism not only reduces, as in the case of the mechanical sutures, and cancels the unset of eschaemic events and of decubiti and above all excludes the phenomena of capillarity that permit the migration of the germs in the subcutaneous tissue and consequently the unset of infection (1, 2, 3, 7).
The cutaneous synthesis with the surgical zippers contributes therefore in reducing the time of operation, in bettering the healing process, the good consolidation, and the aesthetic opinion of the surgical wound and particularly in reducing the onset of infection.
Finally the use of surgic al zipper is without a doubt advantageous as an economical aspect: in fact its cost is comparable to two or three threads of suturae and about half the coast of a skin stapler.
The surgical zipper can therefore be effectively of help in the synthesis of cutaneous wound in operations with complete and local anesthesia, above all in pediatric surgery, and in the sutures of superficial wound in the outpatient's department or in first aid.
We wish that this method of cutaneous suture finds a wide diffusion not only in general surgery but also in other surgical sectors and above all in pediatric surgery because of its almost paioless application.

Summary

The authors introduce the results obtained with the applicationof a new methodic for the atraumatic synthesis of superficialwound that expect the use of a zipper. This experience has been managed from 1994 to 1999 on patients that were affected by different pathologies: abdominal, thoracic, endocrinologic and post-traumatic. The authors describes the technical characteristics of the zipper and the methodic of its application; moreover they present advantages and disavantages of its use comparing it also with others methodics for the skin synthesis such as suture stitches and the graphes.
Finally they examine with criticismthe result obtainedand skin staplers.
Key words: Surgical zipper, skin closure.

References

1) Donini I., Sortini A.: *Le suture meccaniche.* 1ª Edizione, Firenze Ed. Luigi Pozzi, 1984.

2) Edlich R.F., Becker D.G., Thacker J.G., Rodeheaver G.T.: *Scientific basis for selecting staple and tape skin closures.* Clin Plast Surg, 17, 3:571-8, Jul 1990.

3) Carcoforo P., Navarra G., Gasbarro V., Occhionorelli S., Fabbri N., Sortini A., Sartori V., Pollinzi A.: *Le suturatrici meccaniche cutanee.* Minerva Chir, 52:1009-13, 1997.

4) Lubowski D., Hunt D.: *Abdominal wound closure comparing the proximate stapler with sututes.* Aust N Z Surg, 55:405-6, 1985.

5) Lugani P., Di Giorgi S., Laura V., Gori A.: *Le suture cutanee con skin stapler in chirurgia generale.* Minerva Chir, 44:1365-9, 1989.

6) Phung D., Abidin M.R., Thacker J.G., Rodeheaver G.T., Westwater J.J., Doctor A., Edlich R.F.: *Evaluation of automatic disposable rotating cartridge skin staplers.* JBCR, 9, 5:538-46, Sept-Oct 1988.

7) Remelli L., Ventrelli I., Berti G., Pollinzi V., Melandri P., Torboli M.: *Note sulla reazione biologica ai punti di sutura.* Acta Chir It, 42, 5:1004-11, 1986.

8) Stockley I., Elson R.A.: *Skin closure uning staples and nylon sutures: a comparison of result.* Ann R Coll Surg Engl, 69, 2:76-8, Mar 1987.

9) Sapala J.A., Brown T.E., Sapala M.A.: *Anatomic staple closure of midline incision of the upper part of the abdomen.* Surg Gynecol Obstet, 163:283-4, Sept 1986.

10) Zwart H.J., De Ruiter: *Subcuticular, continuos and mechanical skin closure: cosmetic results ol a prospective randomized trial.* Neth J Surg, 41, 3:57-60, Jun 1989.

11) Ranaboldo C.J., Rowe-Jones D.C.: *Closure of laparotomy wounds: skin staples versus sutures.* Br J Surg, 79, 11:1172-3, Nov 1992.

12) Thompson D.P., Ashley F.L.: *Use of the stapler in skin closure.* Am J Surg, 132:136-7, Jul 1976.

13) Antrum R.M., Price J.J.: *Use of skin staples for fashioning colostomies.* Br J Surg, 75, 8:736, Aug 1988.

14) Brickman K.R., Lambert R.W.: *Evaluation of skin staplin for wound closure in the emergency department.* Ann Emerg Med, 18, 10:1122-5, Oct 1989.

15) Jones K.C. Jr, Himel H.N., Towler M.A., Thacker J.G., Edlich R.F.: *New advances in automatic disposable rotating cartridge skin staplers.* Burns, 19, 2:159-65, Apr 1993.

16) Kahn A.M., Geller F., Porter J.: *Innovative applications of skin staplers in operations for burns.* Surg Gynecol Obstet, 155:242-3, 1982.

17) Nakamura M.: *A method to ensure safer skin stapling.* Br J Plast Surg, 45, 3:254, Apr 1992.

18) Ng W.T., Yiu M.K., Wong M.K., Kong C.K., Chan Y.T.: *Use of skin staples for fixation of T tubes and drains.* Surg Gynecol Obstet, 177, 1:93-5, Jul 1993.

19) Pickford I.R., Brennan S.S., Evans M., Pollock A.V.: *Two methods of skin ck closure in abdominal operations: a controlled clinical trial.* Br J Surg, 70:226-8, 1983.

20) Lundblad R., Simensen H.V., Wiig J.N., Niels Gruner O.P.: *Skin closure. A prospective randomized study.* Tidsskr Nor Laegeforen, 109, 12:1307-9, Apr 1989.

21) Teoh M.K., Burd D.A.R., Buckpall T.E.: *Removal of skin staples in an emergency.* Ann of the Royal College of Surgeons of England, 69:222-4, 1987.

22) Carcoforo P., Sortini A., Navarra G., Occhionorelli S., Sartori A., Pozza E.: *Atraumatic skin closure with Fasterzip.* G Chir, 17, 1-2:55-8, 1996 Jan-Feb.

23) Hoffman R., Largiader F.: *Problems with definitive abdominal closure using "zipper" and after left open abdomen.* Helv Chir Acta, 57, 1:47-50, Jun 1990.

24) Hasse F.M., Rademacher C., Bokel G.: *Prospective study of the MEDZIP surgical zipper in relation to efficacy of skin closure, course of wound healing, and results of the healing process in surgical wounds.* Zentralbl Chir, 124, 37:210-3, 1999.

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We certify that:

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- We believe the experimental design and method as well as the collection, analysis, and interpretation of the data are sound.
- We have reviewed the final version of the manuscript and approve it for publication.
- This manuscript has not been published and is not being considered for publication elsewhere.
- We have no conflicts of interest in connection with this paper, other than any noted in the covering letter to the editor.
- All patients gave their informed consent prior to their inclusion in the study.

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Commento Commentary

Prof. Paolo MELITA

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In questo lavoro gli Autori riportano la loro esperienza nella guarigione delle ferite chirurgiche mediante l'utilizzazione dello "zipper". Gli Autori hanno voluto controllare l'efficacia della metodica paragonandola con dei gruppi omogenei di pazienti in cui la sutura della cute è avvenuta con agraphes o tradizionalmente con materiali di sutura. Concordo con gli Autori sull'impossibilità di applicare lo zipper nelle ferite infette o su tessuti patologici, ove l'uso delle suturatrici meccaniche è più opportuno sia per il minor trauma ischemico rispetto ai punti tradizionali, sia per l'inerzia biologica del materiale impiegato.

I risultati ottenuti in questo studio offrono un valido contributo nella ricerca di metodiche alternative nelle guarigioni delle ferite chirugiche, permettendo di considerare di sicuro interesse l'uso dello zipper. Tuttavia, considerando che l'esperienza degli Autori è stata condotta su 213 pazienti, sarebbe opportuno ampliare , lo studio su una casistica numericamente maggiore, al fine di individuare con esattezza i tipi d'intervento chirurgico nei quali è possibile l'utilizzazione di questa metodica.
Credo che sia possibile in ogni caso affermare che lo zipper può condurre ad un i miglioramento funzionale ed estetico dei processi di sintesi tissulare, a condizione che l'indicazione sia esatta e che vi sia una accurata preparazione nell'affrontamento dei margini della ferita.

The authors report their experience about cutaneous syntesis with the use of "surgical zipper". The authors have studied the efficacy of the methodology in comparison with homogeneous groups in which cutaneous synthesis has occured with sutures and agraphes. I agree with the authors on the impossibility to use the surgical zipper on infected wound or on pathologic tissue, in which the use of skin staplers is better for the lower ischemic injury compared with traditional sutures and also for biological inertia of the material used.
The results obtained in this study offer a valid contribution in the research of alternative methods for the treatment of surgical wounds, permitting to consider the use of zipper very important. Nevertheless considered that author's experience has been conducted on 213 patients, it will beopportune to increase this study with a larger record of cases in order to identify precisely surgical operations in which this method is usetul.
I believe that it is possible to affirm that the zipper can permit functional and esthetic results in cutaneous synthesis, but it is necessary a correct surgical indication and a good preparation of wound acies.

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