

THE COMPARISON OF SCALP CLOSURE WITH STAPLES, SILK, PROLENE AND VICRYL FOLLOWING A GILLIE'S TEMPORAL APPROACH FOR MALAR / ZYGOMATIC COMPLEX FRACTURE; A PROSPECTIVE STUDY

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ABSTRACT

This study compared the healing, the type of micro-organisms around the suture material, pain score during removal of suture / staple and cost of the closure material per patient.

Sixty patients were allocated in 4 groups. Each group had 15 patients, aged 16 to 70 years of age with isolated fractured zygoma. They were prospectively randomly selected to have staple, silk, prolene or vicryl rapide for closure of their scalp incision. Patients returned at a week for staple or suture removal, a culture swab, pain score and evaluation of healing. Patients were then reviewed at 6 to 8 weeks time to re-evaluate the healing of the temple / scalp wound.

The wounds in the first group were closed with staples, in the second group with silk, the third group with prolene and the fourth group with vicryl rapide. There were no differences in age, wound length, number of staples / sutures (3), or surgeon experience. There was no difference in wound healing or type of micro-organism around the staples / sutures. Staples resulted in shorter wound closure time but had a higher pain score on the removal (average 2.4 on a visual analogue scale). Staple had a less growth of micro-organisms compared to other groups. The follow up rate was 100%. There was no cosmetic or significant complications problem in any group apart from wound breakdown, one in silk and one in the prolene group that both healed with minor scar formation.

There was no difference in healing in all four groups but staples were easier and faster and had less micro-organisms growth around them. Staples are more expensive and more painful on removal when compared to other groups. The main advantage of vicryl rapide was that there was no need for removal and had comparable results. Silk had the same results as the other groups but is considerably cheaper when compared to the other materials.

Key Words: *Zygomatic complex fractures, Gillies temporal incision, suture materials, complications.*

INTRODUCTION

The history of wound closure dates back to 5500 – 3000 BC, the origin of surgery.¹ Early suture devices were made of natural materials such as silk, linen strips, cotton etc. With the development of synthetic polymers and fibres, synthetic suture materials were introduced. Today suture materials come in many different forms: Natural, synthetic, absorbable and

non-absorbable. The use depends upon the specific site and clinical technique as well as the surgeon's preference.

The goal of wound closure is to bring the edges of the wound together not only with sufficient strength to prevent dehiscence, but also with minimal residual tension and compression of the tissue to promote healing with a cosmetically acceptable scar.

At the same time, there are two effects associated with suturing techniques that need to be addressed. First, the knot tying process leads to residual forces and distortion of the tissue that may impair blood perfusion through the capillaries and can compromise the healing process. The second is the body's natural response to a foreign material which can provoke a significant inflammatory response, particularly at the knot site.²

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The aim of the study was to determine any differences in the healing process / wound complication rate, the type of micro-organism around the suture materials, the pain score at removal of suture / staple and the variable cost of the materials.

METHODOLOGY

A prospective study was conducted over 8 months for patients admitted with fractured zygomatic / maxillary bone who required open reduction and internal fixation. Only Patients between 16 to 70 years of age with fractured zygomatic bone were eligible for study participation. Patients were required to be in generally good health, especially free of those conditions which affect healing process such as diabetes mellitus, congenital or acquired immune-deficiencies, systemic therapy with cytotoxic, antineoplastic or corticosteroid medications etc. Exclusion criteria included pan-facial injuries, or associated other injuries like orthopedics or general surgery etc.

Sixty patients were seen and randomised into 4 groups with respect to the type of wound closure. A sealed envelope method was used. The surgeon was not aware of the method of closure until the start of closure of wound. Wound closure was performed by a single surgeon. The four methods of closure were Staples (Group A), 3/0 Black silk (Group B), 3/0 Prolene (Group C) and 3/0 Vicryl rapide (Group D). Wound in the suture groups were closed with a single scalp layer of simple interrupted sutures (3 stiches) of 3/0 silk (15 patients), 3/0 prolene (15 patients) and 3/0 vicryl rapide (15 patients). Patients in the staple group (15

patients) were closed with automated disposable stapler (3 staples) by using the technique recommended by the manufacturer.

The temple area was cleaned with chlorhexadine antiseptic solution (3%) and a culture swab was taken before giving local anaesthetic injection or the incision. After closure, the temple wound was dressed with 1% chloromycetin ointment and applied three times post-operatively on the ward and at home for 5 days. Antibiotic was given for 5 days (Augmentin or Erythromycin or Clindamycin, if allergic to penicillin). Patients were reviewed at 5 to 7 days post-operatively for evaluation of the wound, a culture swab, the removal of sutures or staples and the pain score. Patients were reviewed once more at a 6 weeks for wound re-evaluation before discharge.

RESULTS

Sixty patients were enrolled in the study and were followed for 6 to 8 weeks post operatively. The age and sex distribution were almost the same in each group. The staples / sutures were removed on average at 6.2 days. (Table 1)

There was no wound infection in any group but there was one wound breakdown in Group B (Silk) and one in Group C (Prolene). Both healed by secondary intention with a small scar formation. No organisms were cultured on swabs from these two wounds. This gives a small complication rate of 6.66% (2/60), (Table 2). No systemic risk factors were noted in these two patients.

TABLE 1: AGE AND SEX DISTRIBUTION AND REMOVAL OF SUTURE / STAPLES

	Group A	Group B	Group C	Group D	Total
No of pts	15	15	15	15	60
Mean age	29.8	32.2	35.7	31.2	
M:F	14:1	14:1	13:2	13:2	
Removal of suture/staple	6.8 (days)	6.1	5.8	0	average 6.2

TABLE 2 : COMPLICATIONS / WOUND BREAK DOWN

	Breakdown	Infection	Pain score
staples	0	0	2.4
Silk	1	0	0.8
prolene	1	0	0.7
Vicryl	0	0	0

The pain score (on a visual analogue scale) during removal of staples / sutures was high in Group A (Staple) as shown in Table 2.

The type of micro-organisms cultured from the staple /suture were almost the same, less common in the staple group as shown in Table 3.

One suture (3/0 silk, or 3/0/prolene or 3/0 vicryl rapide) and one staple gun was used per patient. The

TABLE 3: TYPE OF MICRO-ORGANISMS CULTURED

Group A Pre-op	(Staples) Post-op	Group B Pre-op	(Silk) Post-op	Group C Pre-op	(Prolene) Post-op	Group D Pre-op	Vicryl rapide Post-op
SSA	SSA	SSA	SSA	No growth	No growth	No growth	SSA
CNS	NG	CNS +	CNS++ / SSA	NG	SC	NG	CNS
CNS	NG	CNS +++	CNS +	CNS	SNS	CNS +	SAS
SSA	NG	NG	SC	CS	SSA	CNS	CNS
SSA	SAS	NG	NG	NG	CS	SC ++	SC
SSA	NG	NG	SC	CNS	CNS	NG	SC
CNS	CNS+	NG	SSA	NG	CNS	NG	SC
CNS	NG	NG	CNS	NG	NG	CNS +	CNS /SC
SSA	CNS +	CNS	NG	SSA	NG	CNS	CNS ++
NG	NG	CNS +	CNS +	CNS	SAS +	SSA	CNS
CNS	CNS +	NG	SC ++	CNS	CNS	SSA	CNS +
NG	SC	SSA	SSA	NG	SSA	CNS +	CNS / SC
NG	NG	NG	SSA	NG	SSA	NG	SC
NG	SSA	NG	SSA	CNS	CNS	CNS +	CNS
NG	NG	SSA	CNS	NG	NG	CNS	CNS

SSA=Superficial Skin Flora; NG=No growth; CNS=Coagulase Negative staph, SC=Skin commensals; SAS=Staph aureus scanty

TABLE 4: PRICE

Staple	6.66 Euros
Silk	1.46 Euros
Prolene	1.93 Euros
Vicryl rapid	4.8 Euros

prices are shown in Table 4. The staple gun was the most costly, followed by vicryl rapide. Silk was the most cost effective.

During closure, no sharps injury was noted in any groups.

TABLE 5 : CHARACTERISTICS OF SUTURE MATERIALS

Property	Staples	Silk	Prolene	Vicryl rapide
Handling	Excellent	Excellent	Poor	Good
Knot security	Good	Excellent	Poor	Fair
Tensile strength	High	Good	Moderate	High (absorbed in 35 days)
Coefficient of friction		High	Very low	Medium
Memory		Low	High	Low
Tissue reactivity	Low	High	Low	Low to moderate
Uses	Skin, split thickness skin graft	Mucosa, skin sutures or conjunctive or tissue zones to elevate or retract tissue	Percutaneous, buried if prolonged support is needed	Buried, mucosa and skin sutures
Others		Black	High plasticity, blue or clear	Low elasticity, clear or violet

DISCUSSION

Sutures are used in an attempt to improve the speed of healing and different types of materials can be used to close wound, which range from special glue to wire staples and from animal protein to synthetic materials. The choice of particular suture material should be based on the patient, the wound, the tissue characteristics, the anatomic location and evidenced based medicine. Cost is a significant factor.

No one suture possesses all the desirable characteristics. The optimal suture should be easy to handle, have a high tensile strength and knot security. Any tissue reaction should be minimal. The material should resist infection, have a good elasticity and plasticity to accommodate wound swelling. They should be cost effective. The different properties of these four suture material are shown in Table 5.^{2,3}

Surgical treatments that minimise hospital stay and morbidity are advocated. If post operative complications occur, hospital stay is prolonged and the patient has a higher risk of morbidity and mortality.⁴

Present study has shown a complication (mainly wound breakdown) rate of 6.66% (2/60) with wound closure using silk and prolene and no complication with staples or vicryl rapide. Staples and sutures wounds demonstrated similar mechanical and histological characteristics in animal models.⁵ Contaminated wounds incurred lower infection rate with staples.⁶ Other advantages of staples closure include that they are easy and faster to apply, promotion of wound edge eversion, formation of an incomplete loop with decreased strangulation and lack of residual cross marks, reduce the incidence of infection and provide an alternative if a patient is allergic to suture material.⁷ The vicryl rapide suture for closure of the temple incision was safe and reliable in our study. This is to be expected as other sutures / staples are removed at a week time and the vicryl rapide still maintain some support for the wound at this stage.⁸ The other advantages of vicryl rapide are that it is cheaper than staples and there is no need for suture removal. There is no need for return visits and sterile suture removal kits which reduce the expense and lost wages for our patients or where compliance regarding follow up care is an issue.⁹

Sidebottom et al. in a prospective comparison of methods of closure of the coronal flap, found an infection rate of 2% with staples and a 3% with vicryl and wound breakdown of 8% with vicryl.¹⁰ Mitchell et al. reported 12% rate of wound infection with a bicoronal flap while Kerawala et al. reported 6% infection rate with use of bicoronal flap, though he did not mention the type of closure.^{11,12} Shetty et al. in a prospective study comparing skin staple with subcuticular vicryl found 11% complication rate with staples and 0% with vicryl.¹³ Smith et al. reported 4 times more wound infection with staples compared to suture for skin closure in orthopaedic surgery though he did not mention which suture material had been used.¹⁴ Briancari and Tiozzo found no difference in the risk of wound infection or healing between staples and suture for the closure of leg wounds.¹⁵ Theopold et al. in a randomised controlled trial found no difference between absorbable and non-absorbable sutures for skin closure in hand surgery.¹⁶

In this study, the complication rate in staples and vicryl rapide closure was 0%. This compares favourably with all the above studies. The complication rate associated with silk and prolene (6.66%) is lower than that of Mitchell et al. (12%) and Sidebottom et al. (8%). The reason may be that we have a smaller wound (3 stitches or 3 staples) in the temple area compared to the whole coronal flap. Our results contradicts Shetty et al. where he found 11% complication with staples compared to 0% in our study, though similar complication rate with regard to vicryl rapide (both 0%). The reason here may be that our patient were young and healthy (mean age 30) while patient in his study were old (mean age 82) and were medical compromised.

Evidence based articles have reported better cosmetic results of staples closure compared to those of suture repair.^{17,18} There was also no difference in complication and infection rate.^{18,19,20} Despite increased discomfort on staple removal, patients satisfaction was high. We observed in our study that experience is required to remove staples rapidly and painlessly than was required for suture removal.²¹ No sharp stick injury was reported with staples. This finding is consistent with previous suggestions of decreased risk of sharp stick injury and disease transmission.^{19,20,21}

CONCLUSION

There was no difference in healing in all four groups studied. Stapling is easy and faster. Less micro-organisms grow around staples but they are more expensive and more painful on removal compared to other groups. The main advantage of vicryl rapide is that there is no need for removal and has comparable results. Silk gives the same results as the other groups and is considerably cheaper compared to other materials. We advocate the continued use of 3/0 Black silk sutures for its an efficient, cost effective and comparable aesthetic results.

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