ORIGINAL ARTICLE

A prospective clinical evaluation of the longevity of resorbable sutures in oral surgical procedures

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Abstract

Introduction: The objectives of this prospective randomized study were to clinically evaluate the longevity of resorbable sutures (chromic catgut and vicryl) and determine the effect of chlorhexidine mouth wash on their absorption time in oral surgical procedures. Both sutures were of size 3/0 with round body needle and were placed using the standard technique.
Methods and Materials: One hundred patients selected for the study were divided into two groups of 50 patients each (vicryl and chromic catgut groups). Each group was subsequently subdivided into chlorhexidine (17 cases); warm saline mouth wash (17 cases) and warm water mouth wash (16 cases (control).
Results: The sutures were placed during various minor surgical procedures e.g. third molar surgery (65 cases), incisional biopsy (7 cases), excisional biopsy (8 cases), sutured lacerations (10 cases) and malar elevations through intraoral upper buccal sulci approach (8 cases) and 2 cases of cystic enucleations. The mean longevity of chromic catgut for chlorhexidine was 11.4 days with a range of 5-16 days. The patients, who used warm saline mouth wash, had a mean longevity of 11.7 days with a range of 7-24 days.
The mean longevity of vicryl in patients that used chlorhexidine was 22.7 days, with a range of 14-36 days and that of warm saline mouth wash was 24.5 days with a range of 14-47 days.
Conclusion: The resorbable sutures investigated have a mean longevity, which was slightly shorter than the figure stated by the manufacturer. Chlorhexidine was found to have no appreciable effect on absorption time of the sutures.

Key words: Evaluation, longevity, oral, resorbable sutures, surgical procedure

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Introduction

Most surgical procedures involve incision of the skin, mucosa or tissue and the suturing of the resulting defects. The materials and methods used for wound closure ought to be carefully selected to prepare the wound for healing and if done improperly can prevent normal healing. Furthermore, one of the few signs that patients use to judge the surgeon's skill is the appearance of the sutured wound.[1]

Sutures play an important role in wound healing after surgical interventions and therefore, care should be taken in their selection, especially for intra oral procedures. The mouth differs from other body sites due to the constant presence of saliva, specific microbiota, high vascularization, as well as its functions of speech, mastication and swallowing.[2]

While other techniques for wound closure using, clips, staples, or tissue adhesives have been developed in recent years, the suture continues to be the wound closure device of choice for most procedures.[3] In 1999, there were 41.3 million inpatient and 31.5 million outpatient surgeries performed in the USA. During these surgical procedures, sutures were the most common form of wound closure

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device used. This number of intervention produced a market size of 210 million Dollars worth of surgical sutures.[3]

Machtl *et al.*,[4] found that the perfect suture material does not exist. The choice of a particular suture material should be based on the patient, wound, tissue characteristics, and anatomic location. A surgeon's selection may not be specifically based on scientific data, but rather, on preferences that he or she learned from mentors and/or training.[5]

Surgical sutures as defined by the United States Pharmacopeia are divided into absorbable and non absorbable. Absorbable sutures are defined by the loss of most of their tensile strength within 60 days after placement. They are used primarily as buried sutures.[5]

Synthetic resorbable sutures were developed in response to problems encountered with natural chromic gut and natural chromic collagen, specifically, suture antigenicity, tissue reaction and unpredictable rates of resorption.[5] Sutures are probably the materials most frequently implanted in humans, and are used widely in all fields of surgery.[6]

Clinical and histological reactions of oral tissues to suture materials have been studied and these seem different from that reported at other sites.[7-9] Mechanical properties studied were both tensile strength[10] and the various PH (3-10.0).[11] Several studies have demonstrated that placement of sutures in gingival tissues elicits an inflammatory reaction and that the magnitude of this reaction may vary with the suture material.[12,13] Multi-filamentous sutures are associated with greater reactivity and may promote infection if bacterial contamination occurs during or shortly after surgery.[5,14]

Lilley *et al.*,[15] in a histologic study of the oral tissue response to seven different suture materials, found that the monofilament suture materials and the multifilament resorbable suture materials were associated with milder tissue response compared to non resorbable multifilament suture materials. Giray *et al.*,[16] observed that sutures cause more inflammatory reaction during healing compared with adhesive. Vicryl has produced the mildest tissue reaction among the tested materials.[17]

The materials currently available were not designed for use in the oral environment and their lifespan in this situation has not been previously established.[18] The evolution of suturing material has brought us to a point of refinement that includes sutures designed for specific surgical procedures.[19] Shaw *et al.*,[18], in their study, found that the median survival value were 4 days for gut, 15 days for polyglycolic acid and 28 days for polyglactin (910). Vicryl rapide has been found to last for 3-13 days,[20] chromic catgut 7-10 days when used intra orally.[21,22]

We are not aware of any study conducted in Sub-Saharan Africa on the longevity of resorbable sutures. This formed the basis of this prospective randomized clinical evaluation of the longevity of the sutures and the effect of chlorhexidine mouth wash on their absorption time during oral surgical procedures.

Materials and Methods

This prospective randomized clinical study assessed the longevity of resorbable sutures in oral surgical procedures in 100 patients that presented at the Oral and Maxillofacial Clinic of the Ahmadu Bello University Teaching Hospital over a 12-month period.

The patients were divided into 2 groups of chromic catgut and vicryl using simple random sampling technique and double blinded [Table 1]. The suture materials used were of size 3/0 with round body needles. Sutures had the same expiry date and were made by Ethicon.

Data were collected through patients' interviews; physical, laboratory urine testing, and imaging (periapical, occlusal, plain radiographs) examinations and their blood pressure was measured. Data were recorded by one of the authors (BF) for the selected patients after clinical examination. Also recorded, were type of suture material used, whether chlorhexidine, warm saline mouth washes or warm water was used.

The patients were selected into the major groups (A and B) by picking one of the folded papers the content of which was not disclosed to the researcher. Once in a group, the patients were to ballot from that group into a sub-group by picking a folded paper the content of which was also not disclosed to the investigator.

The surgical procedures ranged from intra-oral incision and excision biopsies, clean lacerations, 3rd molar surgeries and enucleation of small cysts as shown in Table 2. These procedures were carried out either under local anesthesia, local anesthesia with intravenous sedation or general anesthesia. All the procedures were done by the same operator (BF). The technique used was the standardized two clock wise, one anti clock wise and one clock wise to tie the surgical knot.[18]

All discharged patients were reviewed on a weekly basis until all sutures disappeared. Before the patients were discharged, they were shown the sutures that they were to monitor and report when they disappeared. A patient diary was initiated including a diagram of the intra-oral position of the sutures and a table allowing for daily recording of the presence or absence of the sutures. These sutures were marked on a diagram and their appearance and position further described to the patients. The patients were shown the sutures in a mirror to confirm understanding. Patients were asked to inspect them daily and record their presence or absence.[18]

The patients were asked to brush their teeth the way they are used to but to avoid the surgery site. They were also advised not to take sticky food because this could dislodge the sutures.[20]

On loss of sutures, patients completed a questionnaire on any problems caused by the sutures (discomfort, pain, inability to brush, eating with difficulties), which was returned with the diary on the next appointment day. However, confirmations of loss of sutures were done by one of the investigators. When it was confirmed that the sutures have disappeared, the patients were discharged. The mean longevity in each group was computed by adding all the longevities and dividing by the number of longevities (M = EX/N).

This study was approved by the Ethical committee of the Ahmadu Bello University Teaching Hospital Zaria and all patients consented.

Results

Table 3 shows the age distribution of the patients in the chromic catgut and vicryl groups. Majority of the patients in both groups were in the 18-27 age groups.

Of the 100 patients, 92 (44 chromic and 48 vicryl) had their suturing under local anesthesia while 8 patients (6 from chromic catgut and 2 from vicryl group) had malar elevation under general anesthesia. There were 49 females (25 in chromic group and 24 in vicryl) and 51 (25 in chromic catgut and 26 in vicryl) males.

The mean longevity of chromic catgut for chlorhexidine was 11.4 days with a range of 5-16 days. The patients, who used warm saline mouth wash, had a mean longevity of 11.7 days with a range of 7-24 days. Those on warm water mouth wash had a mean longevity of 11.6 days with a range of 6-19 days.

The mean longevity of vicryl in patients that used chlorhexidine was 22.7 days, with a range of 14-36 days that of warm saline mouth wash was 24.5 days with a range of 14-47 days. Patients that used warm water mouth wash had mean longevity of 25.6 days with a range of 14-42 days.

Table 1: Distribution of patients into subgroup

Mouth washes	Sutures					
	Chromic catgut		Vicryl		Total	
	N	%	*n*	%	*n*	%
Chlorhexidine	17	17	17	17	34	34
Warm water and salt	17	17	17	17	34	34
Warm water	16	16	16	16	32	32
Total	50	50	50	50	100	100

In chromic catgut group the overall longevity for surgical extraction patients was slightly longer (12-days) than those of sutured lacerations (11.0 days), excision biopsies (11.2 days) and malar elevations (11.0 days).

Vicryl, had overall mean longevity in patients with cyst enucleation, which was shorter (20.0 days) than malar elevations (21.5 days), excision biopsies (24.0 days), surgical extractions (24.7 days), sutured lacerations and incision biopsies with (25.0 days each). The overall mean longevity of chromic catgut for patients that had general anesthesia was slightly shorter (11.0 days) than those who had local anesthesia (11.4 days). Also in vicryl group, the overall mean longevity of vicryl in patients who had general anesthesia was slightly (21.5 days) but not significantly shorter than in those patients who had local anesthesia (23.7 days).

The mean longevity of chromic catgut and vicryl

The mean longevities of chromic catgut and vicryl in the chlorhexidine were 11.4 and 22.7 days, respectively. The patients on warm saline mouth wash had their longevities for 11.7 and 24.5 days whereas in those on warm water mouth wash, the longevities were 11.6 and 25.6 days. The mean longevity of chromic catgut and vicryl was tested for significance and the result revealed that chromic catgut had less number of days to disappear than vicryl at 5% level of significance ($P < 0.05$) using one way ANOVA.

Table 4 shows the descriptive statistics of the longevity of stitches for the two suture materials. From the table, chronic catgut has a mean of 11.6 with a standard deviation of 0.153 and standard error of 0.088. The 95% confidence interval for the mean of chronic catgut is between 11.2 and 11.9. Similarly, vicryl has a mean of 24.3 with a standard deviation of 1.464 and standard error of 0.845. The 95% confidence interval for the mean of vicryl is between 20.6 and 27.9. The mean plot is depicted in [Figure 1].

The *T*-test results are depicted in Table 5 above, since $P = 0.000 < 0.05$, we therefore, reject the null hypothesis of no significant difference in the longevity between the

Table 2: Distribution of surgical procedures in relation to suture type used

Procedures	Chromic catgut		Vicryl		Total	
	n	%	*n*	%	*n*	%
Surgical extraction	36	36	29	29	65	65
Sutured laceration	4	4	6	6	0	10
Excision biopsy	4	4	4	4		8
Incision biopsy	0	0	7	7	7	7
Malar elevation	6	6	2	2	8	8
Cystic enucleation	0	0	2	2	2	2
Total	50	50	50	50	100	100

two suture materials. Hence, stitches using chronic catgut and vicryl have different longevity. From the descriptive statistics and the mean plot we can conclude that chronic catgut has smaller longevity with a mean of 11.6.

Some sutures in both chromic catgut and vicryl groups were dislodged-they were seen either in the morning or evening, and by the next day in the morning they had disappeared. This loss was confirmed by the investigator (BF) on examination of the patients.

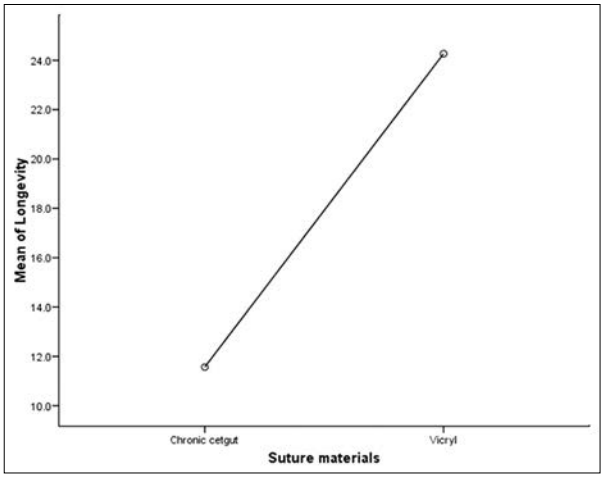

Figure 1: Plot depicting the mean of the sutures

Table 3: Age distribution of patients

Age years	Sutures					
	Chromic catgut		Vicryl		Total	
	n	%	*n*	%	*n*	%
18-27	29	29	24	24	53	53
28-37	13	13	17	17	30	30
38-47	8	8	4	4	12	12
48-50	0	0	5	5	5	5
Total	50	50	50	50	100	100

Table 4: Descriptive statistics

Suture materials	Mean	Std. deviation	Std. error	95% Confidence interval for mean	
				Lower bound	Lower bound
Chromic catgut	11.6	0.153	0.088	11.2	11.9
Vicryl	24.3	1.464	0.845	20.6	27.9
Total	17.9	7.018	2.865	10.6	25.3

Table 5: *t*-test summary

Test values	*t*	df	Sig. (2-tailed)	Mean difference	Std. error difference
	14.94	4	0.000	12.70	0.85

Discussion

Sutures play an important role in wound healing after surgical interventions therefore, the selection of suture materials, especially in oral surgical procedures, ought to be made carefully.

The result of this study shows that chromic catgut is lost from the mouth slightly faster than the manufacturer stated for other parts of the body, which were 14 days and 21 days.[19] The mean longevity was found to be 11.5 days with a range of 5 to 24 days. This could be due to the oral environment, which contains enzymes and a varying PH. Ferguson *et al.*,[23] stated that saliva precipitates the loss of tensile strength of chromic catgut sutures, although the authors did not specify the number of days the sutures lasted. Suture may still be visible yet its tensile strength might have become negligible.[24]

The result of this study shows that vicryl is lost from the mouth slightly faster than the manufacturer stated for other parts of the body (28 days). The suture in the eye could last on the average for 29 days[24] whereas; Shaw *et al.*,[18] documented the mean survival of vicryl in the oral cavity to be 28 days. The findings of this study do not agree with this observation, which may perhaps be due to the lower number of patients the authors studied. Vicryl loses half of its tensile strength in 2 weeks and could be used only when enough healing is expected within that period.[21]

The average longevity of chromic catgut and vicryl were tested for significance and the result revealed that the longevity of vicryl is statistically longer than that of chromic catgut at 5% level of significance, which is in agreement with the manufacturers.[19,21,25] However, the ideal time for suture loss from the oral tissues has not been clearly defined. Nevertheless, in biological terms, suture must function until the wound edges develop sufficient tensile strength to stand alone. Beyond this, the suture merely acts as a foreign body and may impair healing potential. Knowledge of the time of the events in the healing of the oral tissues is therefore important[20] because, during the acute inflammatory phase of wound healing, the tissues do not gain appreciable tensile strength, but depends solely upon the closure material to hold them in approximation.[19]

This study shows that chromic catgut has an overall mean longevity, which was slightly longer in patients who had surgical extractions than in patients who underwent other procedures while vicryl has an overall mean longevity, which was shorter in patients who had enucleation of cysts than in other procedures.

It was noted that resorbable sutures (vicryl and Chromic catgut) used in procedures done under general anesthesia had an overall mean longevity, which was slightly shorter than those done under local anesthesia. The reason for this

is not very obvious and there are no records to compare these observations with, in the literature.

Shaw *et al.*,[18] showed that soft gut, polyglycolic acid and polyglactin 910 (vicryl) have median survival of 4 days, 14 days and 28 days, respectively. In the same study, a group of maxillofacial surgeons stated that their preferred time for suture loss was 5-14 days. On the basis of operator preference therefore, the longevity of both chromic catgut and vicryl are acceptable (Chromic catgut 5-24 days and vicrly 14- 47 days). Perhaps, this time should be based on the knowledge of the timing of the biological events of the healing process and not on the operator's preference.[18] Chromic catgut is a natural absorbable material that is absorbed by enzyme activity and therefore may have a greater potential for inflammation and infection than vicryl, which is removed by hydrolysis.[19,25]

It is noteworthy that natural materials are absorbed by proteolysis, which causes a prominent inflammatory response, while synthetic materials are absorbed by hydrolysis, which produces minimal reaction.[15] Assuming the same technique, tissue and other relative factors, the tissue response to all the sutures is relatively the same for the first 5 days after which the response is more related to the type of suture material.[22]

In conclusion, this study shows that chromic catgut had a mean longevity of 14.5 days and vicryl 24.3 days. These values were slightly lower than the values given by the manufacturer, which were 14 and 21 days for chromic gut and 28 days for vicryl. Vicryl was also found to have longevity greater than chromic catgut at 5% confidence level. Chlorhexidine and warm saline mouth washes were found to have no significant effect on both suture absorption time and bacterial growth on sutures.

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