HEALING OF SURGICAL WOUNDS IN MAXILLOFACIAL REGION — A BANGLADESH STUDY

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ABSTRACT

This prospective study was carried out to identify certain risk factors responsible for delayed incisional healing on day 7 in the maxillofacial region, and was carried out at the Department of Maxillofacial Surgery and Department of Pathology of Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from 1st July 2005 to 30th June 2007.

Six risk factors for delayed maxillofacial area wound healing were studied. Out of 32 patients, cases with risk factors were in study group (mean age 43.5 years) and apparently healthy patients without risk factors were in control group (mean age 45.9 years) were examined. Postoperative clinical evaluation of wound was done on 3rd, 5th, 7th, 9th and 11th day and histological examination of tissue specimen (skin, scalp and oral mucosa) was done on day 0 and day 7 based on six histological parameters of wound healing. Peroperatively taken tissue specimen from the wound margin containing healthy tissue was used as a conrol of postoperative day 7 healing tissue specimen.

Statistically significant association was found between study and control subjects in terms of pattern of collagen tissue and amount of early and mature collagen tissue (p<0.05) on the 7th day of follow up. Clinical evaluation also had strong association with histological state of healing.

It was concluded that patients with risk factors had significantly weaker wounds than those without risk factors.

Key words: *Delayed wound healing, Risk groups, Maxillofacial region, Bangladesh*

INTRODUCTION

Impaired wound healing is a common clinical problem, which is a consequence of disordered collagen formation[1] and underlying predisposing conditions.[2] A weak scar may result from a large number of local or systemic factors.[3] The identification of predisposing conditions is important and beneficial to postoperative management.

In the maxillofacial region clinical skin wound healing occurs in 3-5 days[4] and mucosal wound healing occurs in 5 to 7 days.[5] From the 3rd day onwards a quantitative increase in collagen synthesis occurs and continues up to early 2nd week.[3,6] But no change of quality of collagen fibril occurs.[7] By the 10th the wound has a much greater proportion of tensile strength and it then becomes progressively stronger.[7,8] So a tissue specimen at 7th day of wound healing can provide a fair histological estimation of the process.

Intention of the present study was to evaluate maxillofacial area wound healing on the 7th postoperative day, and to identify the factors influencing delayed wound healing or to prevent further complications. In addition, early identification of patients likely to have a poor clinical outcome, allows them to be better informed about their prognosis and may allow clinicians the opportunity to alter management strategies at an early stage of wound healing.

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METHODOLOGY

Ethical Approval was given by relevant research board and the ethics committee of Bangladesh Medical Research Council, Mohakhali, Dhaka-1212, Bangladesh and relevant judgement's reference number was BMRC/ERC/2004, 2007/754, dated 01/01/06. Based on this ethical approved protocol, all surgical patients of maxillofacial region [age 10-65 years] who gave written consent or written consent from legal guardian and for whom adequate histological material was available or could be obtained was included in this prospective study.

Six known risk factors for delayed wound healing were studied. The factors are local malignancy, diabetes mellitus, local radiotherapy and immunosuppressive drugs (e.g cystotoxic drugs). Thirty two (32) maxillofacial surgical patients were evaluated in this study. The study patients had one or more factors responsible for delayed wound healing. The control patients were apparently healthy and without risk factors. (Table 1)

TABLE 1: DISTRIBUTION OF PATIENTS BY PATTERN OF DISEASES

Pattern of diseases	Frequency	%
Squamous cell carcinoma	11	34.4
Ameloblastoma	5	15.6
Multiple fracture (RTA)	4	12.5
Verrucous carcinoma	2	6.3
TMJ ankylosis	2	6.3
Ossifying fibroma	1	3.1
Chondrosarcoma	1	3.1
Keratocyst	1	3.1
Cementifying fibroma	1	3.1
Dentigerous cyst	1	3.1
Giant cell granuloma	1	3.1
Keratocystic odontogenic tumour	1	3.1
Cemento ossifying fibroma	1	3.1
Total	32	100.0

Out of diagnosis variables, a number of variables like age, sex, site of incision were considered for all subjects.

History, physical examination and standardized criteria as have been previously described were used to identify the six known risk factors responsible for delayed wound healing. To check for infection wound swabs were taken for culture and sensitivity on the 6th postoperative day.[9] Routine and specific histological examinations of specimens were performed.[10] Standard incisions were given for the various procedures and preoperative healthy marginal tissue specimens were used as a control to compare day 7 healing.

Wound healing check list

Examination of the postoperative surgical wound was done on the 3rd, 5th, 7th, 9th and 11th day giving specific attention to the followings; site of wound, length of incision, colour, local temperature, systemic temperature, swelling, tenderness, discharge, wound dehiscence, stitch abscess.[1,11] A modified wound healing check list based on Elbanna Haneya M, Tolba Kawther G and Darwish Olfat A[11] was used. It involved local and general criteria of inadequate wound healing. One score was allotted for each sign of redness, oedema, tenderness, discharge, dehiscence, stitch abscess, raised systemic temperature below 38°C and 2 score for raised temperature above 38°C. Scoring was done by calculating fractions out of 9 with higher scores indicating poorer wound healing. Healing status was graded as good (3-5), fair (6-9) and poor (>9).

Histological evaluation

The peroperative and postoperative day 7 specimens were microscopically examined, based on six histological parameters of wound healing namely[12,13] the amount of granulation tissue, inflammatory infiltrate, collagen fibre orientation, pattern of collagen, amount of early and mature collagen. Granulation tissue and early collagen are present in early stage of wound healing. Horizontally oriented fascicle forming, mature collagen fibres on day 7 are signs of good healing.[6,7,13] In comparison profound amount of granulation tissue, plenty of inflammatory infiltrate with vertical orientation of reticular collagen and limited mature collagen indicate delayed healing[13,14] (Figs 1-4)

Scoring criteria: The following scoring criteria was developed to compare healing status in both study and control groups as a modified form which was used by Mustafa[13], in an ascending order for specific points. They were as follows:
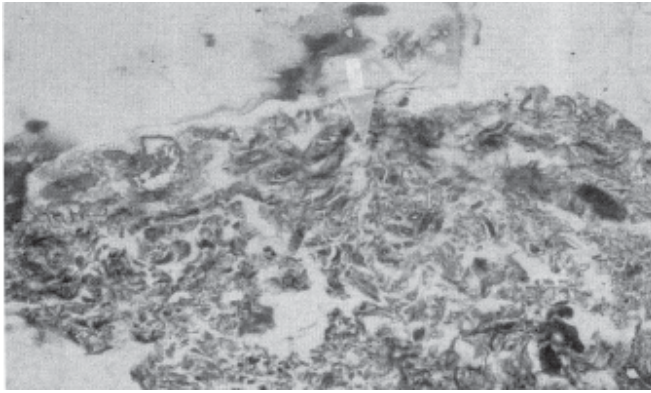
Fig 1: Photomicrograph of skin of 7th postoperative day showing reticular collagen, vertically oriented along the scar line, inflammatory cells moderate. Delayed wound healing. (Masson's Trichrome stain x 100).
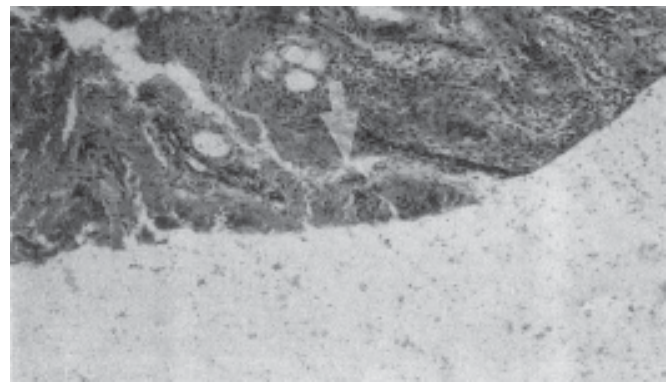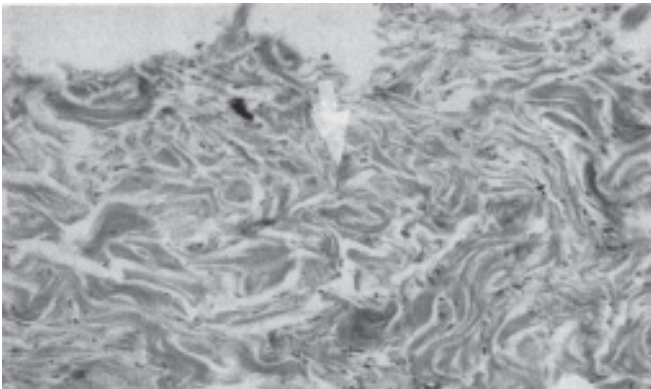

Fig 2: Photomicrograph of skin of 7th postoperative day showing horizontally oriented fascicile type of profound darkly stained collagen fibre. Good healing. (Masson's Trichrome stain x 400).

Histology, at initial surgery and on postoperative day 7

Specific points with routine stain

Amount of granulation tissue	(1-4, Profound to Absent)
Inflammatory infiltrate	(1-3, Plenty to little)
Collagen fibre orientation	(1-3, Vertical, mixed, horizontal)
Pattern of collagen	(1-3, Reticular, mixed fascicular)

Specific points with specific stain

Amount of early collagen	(1-4, Profound to Absent)

Fig 3: Photomicrograph of mucosa of 7th postoperative day showing reticular collagen, vertically oriented. Delayed healing. (H & E stain x 200).
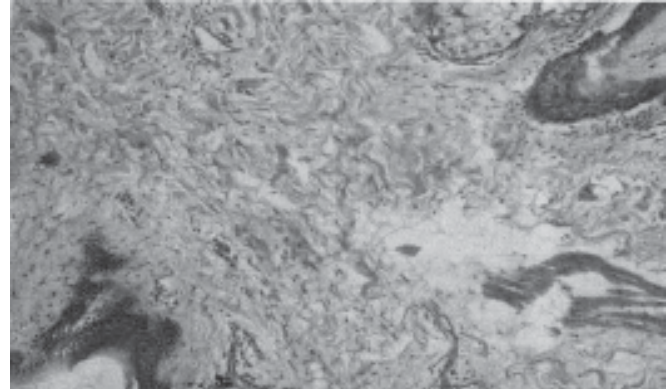

Fig 4: Photomicrograph of scalp tissue of 7th postoperative day wound showing profound horizontally oriented fascicle type of collagen fibre. An example of good healing. (H & E stain x 100).

Amount of mature collagen	(1-3, Profound to Minimal)

Healing status was calculated by adding the score of individual criteria and was graded as good (16-19), fair (12-15) and poor (08-11).

Data collection and analysis

All the data and information were analysed with the help of computer SPSS software. Results of study were calculated by standard statistical methods (descriptive statistics and inferential statistics).

RESULTS

The mean age of the experimental subjects was slightly lower than that of the controls (43.5 and 45.9

years, respectively, t = 0.618). No statistically significant mean age difference was detected among subjects of the two groups. Similarly analysis found no statistically significant sex difference between two groups of patients though the mean age of the female patients was a little bit higher than the male patients. Among the study patients 11.8% patients found to have sign of infection. However, among the control group no patient had sign of infection. Among the study patients 29.4% patients had no systemic disease and 70.6% had systemic diseases. The most frequent systemic anomalies were malnutrition of different grades (47.0%). Mild (17/6%), moderate (17.6%) and severe malnutrition (11.8%). History of radiotherapy and chemotherapy (5.9%). History of chemotherapy (5.9%) and 11.8%) had diabetes mellitus (Table 2).

Correlation matrix between healing score and selected variables shows significant negative association between risk factors indicating that healing was better among the patients with low risk factors and better among the patients with lower age, male sex and minimum surgical incision. However, the correlation was not statistically significant (Table 3).

The mean healing score of the patients having no systemic disease was 12.0 ± 3.5 and for the patients systemic disease was 11.8 ± 2.2. However, analysis found no statistically significant mean difference between two groups (p>0.05). On follow up clinical parameters of the control group showed the appearance of normal colour of postoperative wound at 5th day observation and became hundred percent healthy at 7th day observation which was early in comparison with study group where the normal colour appeared in all the patients at 9th day of observation. Other parameters also showed similar patterns.

TABLE 2: DISTRIBUTION OF PATIENTS BY CONSIDERED RISK FACTORS

Any systemic disease	Study subjects				Total	
	Group I (study)		Group II (Control)			
	No.	%	No.	%	No	%
Nil	5	29.4	15	100.0	20	62.5
Diabetes mellitus	2	11.8	0	0.0	2	6.3
Mild malnutrition	3	17.6	0	0.0	3	9.4
Moderate malnutrition	3	17.6	0	0.0	3	9.4
Severe malnutrition	2	11.8	0	0.0	2	6.3
History of radiotherapy and chemotherapy	1	5.9	0	0.0	1	3.1
History of chemotherapy	1	5.9	0	0.0	1	3.1
Total	17	100.0	15	100.0	32	100.0

TABLE 3: CORRELATION MATRIX BETWEEN HEALING SCORE AND SELECTED VARIABLES

Parameters	Healing score	Age in years	Sex	Length of Incision (cm)	Risk factors
Healing score on 7th day	–	–	–	–	–
Age in years	-0.082	–	–	–	–
Sex (0=female, 1=male)	0.198	-0.067	–	–	–
Length of incision (cm)	-0.346	-0.232s	0.154	–	–
Risk factors (0=none, 1=present)	-0.409*	-0.104	-0.313	0.055	–

*Correlation is significant at the .05 level (2 tailed)

TABLE 4: PERCENTAGE DISTRIBUTION OF PATIENTS BY HISTOLOGICAL FINDINGS

Parameters	Study (n=17)		Control (n=15)		P value
	XXInitial	7th day	XXInitial	7th day	
Amount of granulation tissue					
Profound	0.0	0.0	0.0	6.7	p>0.05
Moderate	0.0	17.6	0.0	20.0	
Scanty	0.0	64.7	0.0	20.0	
Absent	100.0	17.6	100.0	53.3	
Inflammatory infiltrate					
Plenty	0.0	5.9	0.0	0.0	p>0.05
Moderate	0.0	58.8	0.0	40.0	
Few	100.0	35.3	100.0	60.0	
Collagen fibre orientation					
Vertical	0.0	47.1	0.0	35.3	p>0.05
Mixed	0.0	47.1	0.0	33.3	
Horizontal	100.0	5.9	100.0	33.3	
Pattern of collagen					
Reticular	0.0	35.3	0.0	0.0	p<0.05
Mixed	0.0	52.9	0.0	60.0	
Fascicle	100.0	11.8	100.0	40.0	
Amount of collagen (Early)					
Profound	0.0	17.6	0.0	6.7	p<0.001
Moderate	0.0	64.7	0.0	6.7	
Minimal	0.0	11.8	0.0	86.7	
Absent	100.0	5.9	100.0	0.0	
Amount of collagen (Mature)					
Minimal	0.0	88.2	0.0	13.3	p<0.001
Moderate	0.0	5.9	0.0	26.7	
Profound	100.0	5.9	100.0	60.0	
Healing score	20.0	11.9±2.5/20 (9.0-18.0)	20.0	15.5+3.2/20 (8.0-19.0)	

Percentage distribution of patients by histological findings showed initially all the study and control had similar pattern of microscopic feature but on the 7th day of follow up of the histological pattern was found to be different which was assessed on the basis of arbitrary score. There was statistically significant association between study and control subjects, in terms of pattern of collagen tissue and relative amount of early and mature collagen tissue ($p < 0.005$) indicating the delayed wound healing among the study patients (Table 4).

Further analysis indicates that the mean score of histological pattern was significantly low among the study patients (11.9 ± 2.5) compared to control (15.5 ± 3) and the mean difference was statistically significant ($p<0.001$).

DISCUSSION

It is well known that wound healing is faster in the young age and it is normal in middle age unless associated with some debilitating disease. The multifactorial nature of healing in the elderly makes it difficult to determine whether impaired healing is due to aging process or to other factors. So, different age groups were taken both for study and control group, and sex was matched. This study findings were compared with previous studies results.[11]

Though statistically not significant, in this study healing was found better among male which was different from other studies.[14] It is well documented that sex hormones modulate healing and males are vulnerable to delayed healing. These gender related trends warrant further investigation.

The mean length of incision was 17.9 cm for study group and 12.3 cm for control group. The mean difference was statistically significant. But to find out any relationship of healing status with selected variables like length of incision, correlation matrix between healing score and selected variables was done. Though it was found statistically not significant it also warrants further investigation. It also compares with Demarchez et al 1986, Cavani et al 1993, cited in Escamez et al[12], which shows small incision heals early.

It was found that on histological evaluation of wound different microscopic features displayed the definitive histologic state of healing wound. Out of 32 patients 17 patients were with risk factor in study group from those 14 patients showed fair healing and only one patient showed good healing in comparison with 15 control group patients without risk factor, where good healing was observed in 10 patients, fair healing showed in 4 patients and poor healing only in one patient. It may be mentioned that the above results of poor healing in study group were observed only on 7th day after surgery. Subsequent healing condition after 7 days of study needs further follow up to comment about late healing condition of study group.

It was also found that on clinical assessment normal colour appeared early in control group patients without risk factors than with risk factors in study group. Similar pattern of hotness, swelling and tenderness were found during follow up period in both study and control group, indicating that there was strong association with histological state of healing.

Though all risk factors of wound healing like, operative factor, severity of surgical trauma etc could not be evaluated the present study distinctly pointed out that risk factors in the study group had significantly weaker wounds than the control group without risk factors.

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