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**Dr. Amit R Kale**  
M.S. Ortho, DNB Ortho, Mch,  
MRCS (UK), Associate Professor  
and Head of Unit, Department  
of Orthopaedics, B.J. Medical  
College & Sassoon General  
Hospital, Pune, Maharashtra,  
India

**Dr. Chandrashekhar S Sonawane**  
M.S. Ortho, Senior Resident,  
Department of Orthopaedics,  
B.J. Medical College & Sassoon  
General Hospital, Pune,  
Maharashtra, India

**Dr. Aniket A Wagh**  
Junior Resident,  
Department of Orthopaedics,  
B.J. Medical College & Sassoon  
General Hospital, Pune,  
Maharashtra, India

**Dr. Hitesh J Mangukiya**  
M.S. Ortho, Assistant Professor,  
B.J. Medical College & Sassoon  
General Hospital, Pune,  
Maharashtra, India

**Dr. Vijay U Waghmare**  
Junior Resident, B.J. Medical  
College & Sassoon General  
Hospital, Pune, Maharashtra,  
India

## Correspondence

**Dr. Chandrashekhar S Sonawane**  
M.S. Ortho, Senior Resident,  
Department of Orthopaedics,  
B.J. Medical College & Sassoon  
General Hospital, Pune,  
Maharashtra, India

## A retrospective study of effect of anaemia on split thickness skin graft uptake in orthopaedic trauma cases

**Dr. Amit R Kale, Dr. Chandrashekhar S Sonawane, Dr. Aniket A Wagh, Dr. Hitesh J Mangukiya and Dr. Vijay U Waghmare**

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### Abstract

**Introduction:** Haemoglobin level in blood is traditionally considered to be directly affecting wound healing.; Hence many times blood transfusion to patients with anaemia is given in order to achieve better wound healing.

**Material and Method:** This retrospective observational study was conducted from July 2017 to October 2017 at Department of Orthopaedics, B.J. Medical college & Sassoon General Hospital, Pune, Maharashtra. Records of those patients with orthopaedic trauma who underwent split thickness skin grafting were analyzed. Split thickness skin graft uptake was evaluated in 31 patients with anaemia (Haemoglobin <10/dl) and compared with control group (Haemoglobin level of 10 or > 10 gm/dl)

**Results:** No statistically significant difference was found in mean graft uptake between two groups.

**Conclusion:** Mild to moderate anaemia does not deleteriously affect split thickness skin graft uptake provided perfusion is well maintained with effective circulatory volume. Hence if anaemic patient is asymptomatic and without any cardiovascular or pulmonary compromise because of anaemia, prophylactic blood transfusion for better wound healing in terms of split skin graft uptake is not indicated.

**Keywords:** Anaemia, blood transfusion, orthopaedic trauma, split skin graft uptake, wound healing

### Introduction

The importance of sufficient oxygen supply and avoidance of wound infection in wound healing is well known. By reducing the wound tensile strength, arterial hypoxia delays the normal healing process has been shown in animal studies<sup>[1]</sup>. It has been traditional wisdom to maintain haemoglobin level above 10 gm/dl in order to promote good wound healing<sup>[2,3]</sup>. As a result, many of the surgeons are advocating blood transfusion in order to raise the haemoglobin level and indirectly achieve better wound healing. The decision to transfuse the blood either preoperatively or postoperatively is taken if the patient's haemoglobin level is <10 gm/dl. This is principally done assuming that risk benefit ratio favours blood transfusion in anaemic patients.

But recent studies have made it increasingly clear that although blood transfusion can be potentially beneficial, it is not without risks<sup>[4]</sup>. It has also been found that Blood transfusions have non-specific immunosuppressive properties that increase susceptibility to infectious complications and also retard wound healing itself<sup>[5,6]</sup>.

The present study was conducted to evaluate the state of wound healing in terms of split thickness skin graft uptake in anaemic patients compared with non-anaemic patients.

### Material and Methods

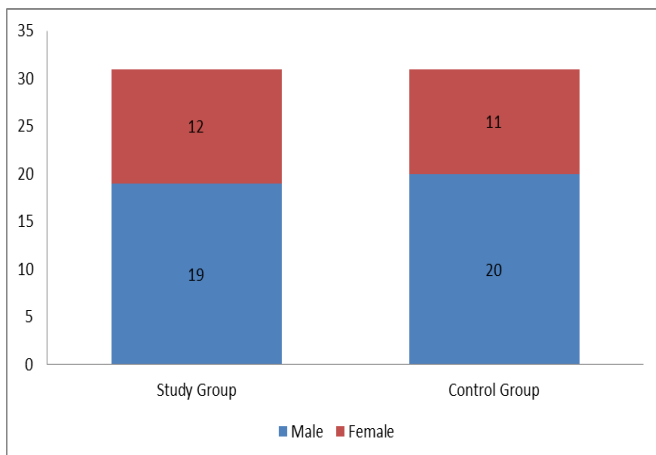
This retrospective observational study was conducted from July 2017 to October 2017 at Department of Orthopaedics, B.J. Medical college & Sassoon General Hospital, Pune, Maharashtra. Records of those patients with orthopaedic trauma who underwent split thickness skin grafting were analyzed.

Hospital records of orthopaedic patients who underwent split thickness skin grafting between February 2016 to June 2017 were assessed. Those patients who were not given blood transfusion after recipient skin graft site was granulated were included in the study.

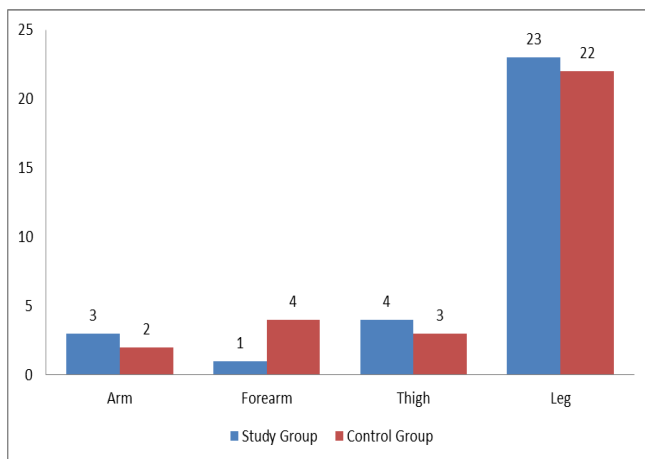
Data was obtained from patient’s record with regard to age, sex, pre and post skin graft haemoglobin, limb and body part which was skin grafted, approximate area of of skin graft recipient site in cm<sup>2</sup> percentage of skin graft uptake on 10<sup>th</sup> post graft day and complications over period of 1 month, Patients with known history of diabetes mellitus, hypertension, nephritis, jaundice, bronchial asthma, tuberculosis, malignancy and history of steroid administration were excluded. Those patients who had been given blood transfusion after the skin graft recipient site had granulated were also excluded from the study. After considering inclusion and exclusion criteria, 62 patients were included in study. Patients were divided into study groups (n = 31) with haemoglobin < 10 g/ dL, and control group (n = 31) with haemoglobin level = or > 10 g/dL. Statistical analysis was done using Chi Square test and level of significance was taken as <0.05.

**Results**

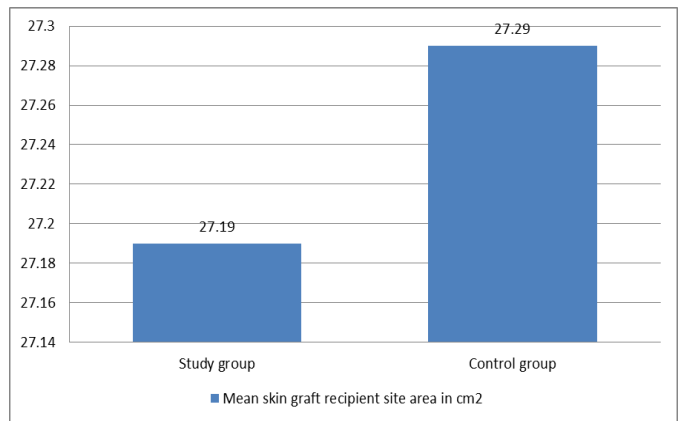
The youngest patient was 8 years old and the oldest was 78. There were 19 (61.30%) males and 12 (38.70%) females in study group and there were 20 (64.52%) males and 11 (35.48%) females in control group [Figure 1]. Overall, 52 (83.87%) Patients had recipient skin graft site in lower limb and 10 (16.13%) patients had in upper limb. In the body part, leg was the most common part to be skin grafted in both study as well as control group [Figure 2]. Mean area of skin graft recipient site was 27.19 cm<sup>2</sup> in study group and 27.29 cm<sup>2</sup> in control group [Figure 3].



**Fig 1:** Genderwise distribution of study and control group patients



**Fig 2:** Distribution of skin graft recipient site in study and control group.



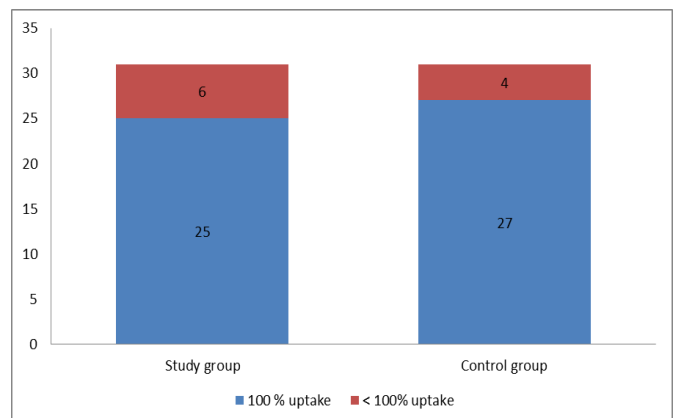
**Fig 3:** Mean skin graft recipient site area in study and control group.

The mean pre-skin graft haemoglobin level in the study group was 8.03 g/dL (range 7g/dL to 9.5 g/dL). The mean 10<sup>th</sup> post-skin graft day haemoglobin level in the study group was 7.98 g/dL (range 7g/dL to 9.5 g/dL) [Table 1]. The mean pre-skin graft haemoglobin level of control group was 11.20 g/dL (range 10g/dL to 14.5 g/dL). The mean 10<sup>th</sup> post-skin graft day haemoglobin level was 11.20 g/dL in the control group (range 10g/dL to 14.5 g/dL) [Table-1].

**Table 1:** Mean pre and post skin graft haemoglobin level in study and control group.

	Pre-skin graft mean Haemoglobin level (g/dl)	10 <sup>th</sup> post-skin graft day mean Haemoglobin level (g/dl)
Study group	8.03	7.98
Control group	11.20	11.20

Evaluation of graft-uptake done on the 10<sup>th</sup> postoperative day revealed 100% graft take in 25/ 31 (80.64%) patients among study group and 27/ 31 (87.10%) patients among control group [ Figure 4]. <100% graft uptake was observed in 6 (19.36%) patients among study group of which 3 (9.67%) patients had infected graft and in total 5 (16.12%) of the patients in study group required re grafting.



**Fig 4:** Skin graft uptake on 10<sup>th</sup> post skin graft day among study and control group.

In the study group 1 patient (3.22%) developed graft contracture, and 2 patients (6.45%) developed keloid in the followup [Table 2]. In the control group <100% graft uptake was observed in 4 (12.90%) patients of which 2 patients (6.45%) had infected graft [Table 2]. In the control group, total 4 patients (12.90%) required re grafting, 1 patient (3.22%) developed contracture of graft, and 1 patient (3.22%)

developed keloid at recipient site [Table 2]. Graft take was almost in equal proportion in study and control group. Statistically there was no difference in the skin graft uptake in both groups.

**Table 2:** Distribution of complications among study and control group.

Complication	Study group (n=31)	Control group (n=31)
Graft failure requiring regrafting	5 (16.12%)	4(12.90%)
Infection requiring regrafting	3 (9.67%)	2(6.45%)
Graft contracture	1 (3.22%)	1(3.22%)
Keloid	2(6.45%)	1(3.22%)

## Discussion

Poor wound healing is caused by many factors like anaemia, hypoproteinemia, infection, and prolonged use of steroid; As the haemoglobin is considered essential to maintain proper oxygenation; anaemia is frequently blamed for poor wound healing [7]. Many a times elective surgery is usually delayed to manage this deficiency of haemoglobin, either by preoperative haematinics or by blood transfusions. The effect of anaemia on wound healing has still remained uncertain and the age old dictum that a patient with haemoglobin level < 10 gm% requires blood transfusion is followed. Despite various human and animal studies, no clinical consensus has been arrived at on threshold value for prophylactic blood transfusion in anaemic patients. However, studies have demonstrated that weakness at rest usually does not occur until haemoglobin level falls below 6g/dL and cardiovascular failure does not occur in normovolaemic, anaemic individuals until haemoglobin level falls below 3-4 g/dL [4]. Arterial blood carries O<sub>2</sub> as oxy- haemoglobin in the red blood cells which upon exposure to low tension of oxygen in the wounded tissues, dissociates and oxygen leaves the blood stream and enters into the tissues. The wounded tissue has increased CO<sub>2</sub> tension, decreased O<sub>2</sub> tension, decreased velocity of blood, vasodilatation and increased temperature which favours the dissociation of oxy-haemoglobin thus supplying more oxygen to the wounded tissue. Because of increased cardiac output, decreased blood viscosity and decreased peripheral resistance seen in anaemia; tissue perfusion is increase thereby reducing the ill effects of anaemia [8, 9]. It has been found in animal studies that haemoglobin as low as 2-3g/dL is compatible with normal development of tensile strength provided blood volume remains normal [10].

Thus, normal physiological responses to anaemia tends to restore the normal oxygen delivery to the tissues. At the same time, it cannot be denied that at some point, the oxygen carrying capacity is no longer sufficient to maintain PO<sub>2</sub> in the capillaries and in the tissues and thus that level of anaemia would be detrimental for wound healing. Various studies have found out this threshold at haemoglobin of 6 g/dL and this point is considered as the transfusion trigger [11].

In our study, No statistically significant difference was found in split thickness skin graft uptake between both study and control group implying that mild to moderate anaemia do not necessarily delay wound healing. This shows that perioperative blood transfusion can be avoided in orthopaedic trauma care patients who have normovolaemic anaemia without mortality and without significant morbidity.

Limitations of our study are those inherent to all designs that use data collected from medical records, such as reliability

and incompleteness of information.

We categorized our patients using World Health Organisation (WHO) classification. According to WHO, anaemia is classified as mild when haemoglobin is between 9-11 gm%, moderate when haemoglobin is 7-9 gm% and severe in cases of haemoglobin less than 7 gm% [12].

## Conclusion

It is not mandatory to keep haemoglobin level at or >10 g/dL for skin graft uptake, as mild to moderate anaemia does not have any deleterious effect on wound healing in terms of skin graft uptake if perfusion is maintained by adequate circulatory volume. For asymptomatic anaemic patients without significant cardiovascular or pulmonary disease, Prophylactic transfusion of the blood for the purpose of wound healing is not indicated. In a patient with significant cardiovascular or pulmonary disease, decision to transfuse the blood must be individualized. Considering the awareness of risks of blood transfusion, Avoiding unnecessary transfusions would be beneficial.

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