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Original Research Article

Smart Phone Photography as a Reliable Adjunct in Free Flap Monitoring: An Experience from a South Indian Post-Graduate Training Institute – Original Research

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Abstract

Objectives: Postoperative free flap monitoring is crucial as early detection of flap compromise and intervention can substantially increase the flap survival rate. Primary observers of free flap in recovery room is different dependent on the on-duty resident in most of the teaching institutions. A standardized free flap surgical protocol and postoperative monitoring is essential in these circumstances.

Methods: 10 patients who underwent free flap reconstruction for oral cavity cancer ablative surgery using our standard patient section, pre-operative assessment, surgical protocol were included in this study. Post operatively, along with the clinical assessment of flap, smartphones were used to capture flap photos under standard lighting conditions and real time assessment was done using a WhatsApp messenger group by sending it to the operating surgeons and residents. The photos were assessed for any colour or texture change and in case of any flap compromise, patient was taken back to operation room without any delay.

Results: Our protocol helped in reducing the time interval between identification of the flap compromise and re-exploration, which is the one important factor for flap survival. The flap taken for re-exploration in our study group was salvaged successfully.

Conclusion: We suggest a cost-effective, simple and less time consuming multidisciplinary free flap monitoring protocol using smart phone photography and a messenger for evaluation by the operating team and the residents would be an effective method along with clinical monitoring for substantially increasing the success of free flap salvage rates especially in a teaching institution.

Keywords: Oral Cancer, Plastic and reconstructive surgery, Microvascular surgery, Head and Neck Oncology, Free Flap Surgery

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INTRODUCTION

With recent advances in reconstructive surgery, the success rate of free flap anastomosis is > 90% [1,2]. Close monitoring of these flaps for early detection of vascular thrombosis and intervention can further enhance the success. The gold standard in flap monitoring is the clinical observation of flap colour, turgidity, temperature and capillary refill [2]. Clinical monitoring in a tertiary centre involved in training postgraduate trainees requires strict monitoring and stringent protocols to be in place to assure predictable success outcomes.

Clinical observations are observer-dependent and can influence the overall success of flap survival. With the availability of high-speed internet connectivity and easy access of high-resolution imaging through smartphones, using standard lighting conditions, we attempt at putting forward a free flap monitoring protocol for predictable free flap success outcomes. This study puts forward a standard simple, convenient, cost-effective and less time-consuming protocol for the management of patients undergoing microvascular free flap transfer in oral and maxillofacial region and postoperative monitoring of these flaps.

MATERIALS AND METHODS

In a pilot study conducted at the SDM Craniofacial Surgery and Research Centre, 10 consecutive patients who underwent composite resection of the tumor by the faculty of Oral & Maxillofacial Surgery, free tissue transfer was performed by the faculty of Plastic and Reconstructive Surgery. Ethical clearance obtained from Institutional Review Board.

All suspected cases of oral cancer underwent an incisional biopsy in our unit and the biopsy proved patients undergo a pre-operative Computed Tomography scan of 1mm thickness of the face with contrast and DentaScan. High resolution Ultrasonography of the lesion and Neck was performed to ascertain the nodal status of all the patients.

The extent of spread of the tumour and the clinical staging governed the choice of resection and subsequent reconstruction. Following a review of the case with a joint discussion amongst the resective and the reconstructive teams, the most appropriate flap of choice was chosen keeping in mind the anatomy to be reconstructed and the function to be restored. Colour Doppler study of the respective vascular pedicles was performed for all patients before the surgery.

The protocols followed for preoperative management of all patients scheduled for tumour ablation and free tissue transfer include:

- Optimizing the patient and getting clearance for surgery from the anaesthetic team.
- All patients undergoing free flap surgery were tracheostomized.
- Following resection, the recipient vascular bed was prepared and using a tourniquet time of t=<2hours, the tissue was harvested.
- Following anastomosis of the vessels, layered closure of the wound was performed.
- Minivac drains are placed to eliminate dead space and to evacuate serosanguinous fluid from the operated site. all measures are incorporated to maintain adequate flow through the anastomosis site.
- Normotensive anesthesia, adequate fluid load, maintaining adequate input/output and adequate temperature in the surrounding post-operative recovery ward was maintained. Air conditioning of ward is avoided.
- Instituting aspirin 75mg H/S on second postoperative day was followed for all patients. Vitals were optimized, intra venous fluid resuscitation,
- 30-degree head end elevation and same head position was maintained for all the patients.

Valid written informed consent for capturing and uploading pre, intra and post of photographs obtained from all patients.

Flap monitoring protocol includes clinical monitoring of flap for:

- Color, turgidity, temperature and needle prick test every 30 minutes for 2 hours post-operatively and then hourly monitoring was done for the next 72 hours.
- A photograph of the flap was taken using a smartphone with camera and light settings to assess the arterial and venous flow and integrity.

A One Plus 7T Pro (One plus technology Co. Ltd., China) smart phone was used to capture the flap photographs using standard light (Hanualux Blue 30), focal length and aperture. Photographs were uploaded to a WhatsApp group with all surgical team as members (Figure 1). Any change in colour of the flap was assessed with comparing to the previous photographs at regular intervals as mentioned. Clinical and photographic assessment stopped once the operating surgeon decided to take the patient back to OT for re-exploration or after 48 hours of uneventful period [1].

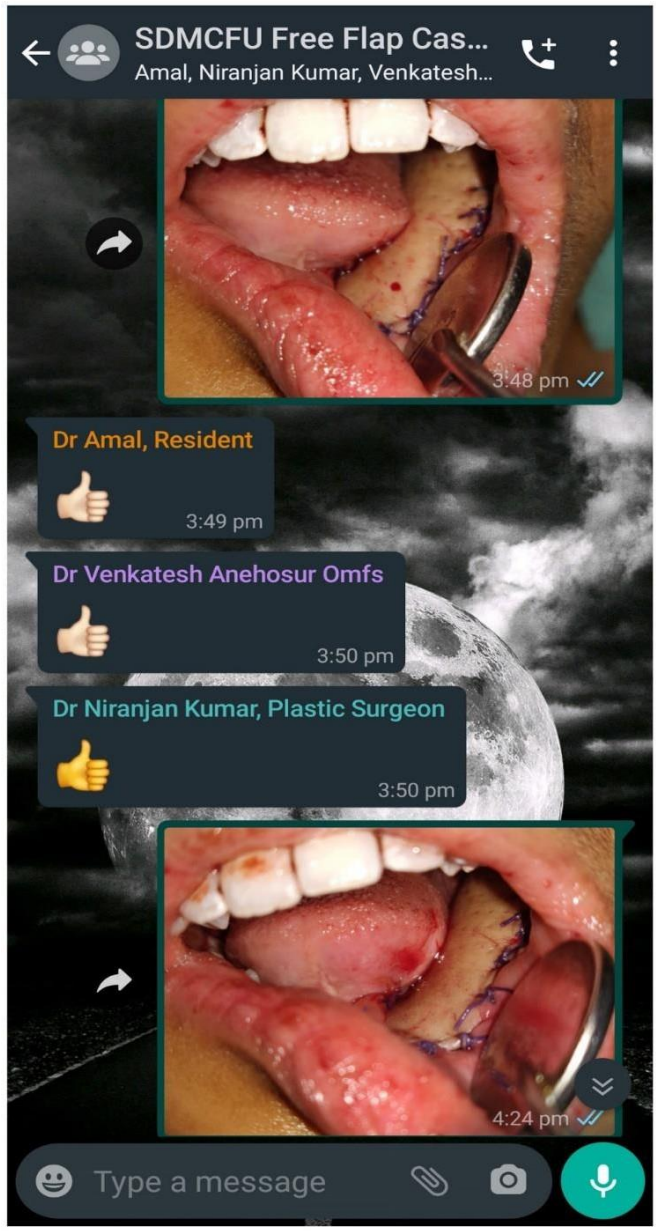

Figure 1: Realtime assessment of flap photographs using WhatsApp messenger.

RESULTS

In a pilot study including consecutive 10 patients undergoing microvascular free flap transfer in the oral and maxillofacial region were monitored. Only one patient in our study group underwent re-exploration (Figure 2) and the other 9 flaps healed uneventfully. One patient was taken up for flap salvaging after 4 hours postoperatively when the flap photograph showed a significant color change which indicated flap cyanosis. On clinical assessment, the prick test was negative. The flap survived after re-exploration. Our protocol helped in early detection of flap compromise and also reduced the time interval between identification of signs of thrombosis and re-exploration which is the key factor for increased flap survival rates.

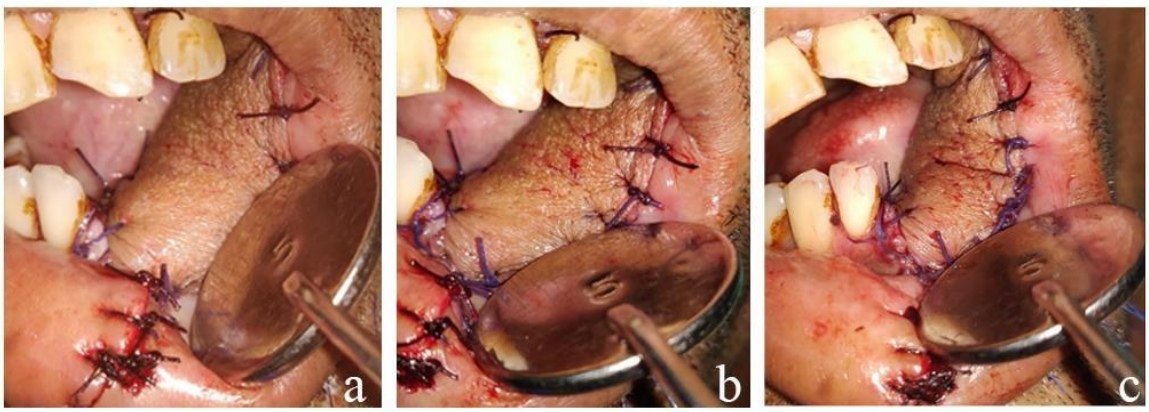

Figure 2: Free flap photographs taken at immediate postop, 2 hours post op and 4 hours post op showing colour changing dusky.

DISCUSSION

Microvascular free tissue transfer is a reliable method for reconstruction of complex surgical defects in oral and maxillofacial region. Success rate of these flaps is likely attributable to technological advancements in preoperative planning, intra-operative surgical techniques and equipment and postoperative flap monitoring. Despite of these advancements, there is still lacuna present in timely identification of flap compromise. The time interval between flap compromise and re-exploration in a key factor in salvaging these flaps [2]. The high success rate in our centre is accredited to the strict protocol followed in management and monitoring of these patients.

The most common causes for flap compromise include pedicle thrombosis, bleeding or hematoma, kinked pedicle due to poor orientation, suturing flap in tension and patient factors like vigorous neck movements [1,3-7]. Most of these flaps can be effectively salvaged by prompt identification of flap compromise and immediate re-exploration. A study conducted by Duc T. Bui and colleagues observed a significant difference between flaps that were reexplored less than 5 hours after detection compared with those that were reexplored more than 5 hours after detection [1]. Our experience is also consistent with this observation. In the patient taken back to operating room immediately after detection of flap compromise, the flap was salvaged.

The protocol of flap monitoring using smartphone photography and transferring it via WhatsApp messenger to the operating surgeons have undoubtedly helped us immediately recognising the change in colour and turgidity of the flap, which are known indicators for flap compromise, when it initiates itself. The ease of transmission of photos via smartphone and avoiding inter person observer bias makes this a potential tool for relatively accurate assessment of free flap in a timely fashion [8-10]. Our study is similar to that of Kim et al where he used digital imaging in evaluation wound [11]. The time frequency of flap monitoring to be kept as half an hourly for 2nd postoperative hour and then extending it to every hourly aid in early identification of flap compromise. Various studies have demonstrated that the salvage rate venous thrombosis is higher than that of arterial thrombosis due to the difficulty in detecting a pale ischemic flap than a congestion in flap [8-10]. Our method of photographic monitoring under standard light settings could detect both pale and dark colour changes in flap very effectively. This is one of the main advantages to this technique when used in conjunction with the clinical assessment my maintaining temperature, turgidity, colour and needle prick test.

Most of the flap failure happens in the first 72 hours post operatively [8]. Tracheostomising the patient also significantly reduces the vigorous neck movements and reduces the manipulation and the duration of induction of anesthesia to the patient taken back to operating room for re-exploration. The vacuum assisted drain kept in situ would instantly remove any edema fluid collection or hematoma around the anastomosis site. This also reduces the chance of early flap compromise. Flap compromise due to vasospasm can be reduced by keeping the Intensive Care unit in ideal temperature, by avoiding air-conditioning or using any other temperature controlling devices.

CONCLUSION

To conclude, we suggest a cost-effective, simple and less time consuming multidisciplinary free flap monitoring protocol using smart phone photography to be done under standard light settings and transferring it via a messenger subjecting it for evaluation by the operating team and the residents would be an effective method for substantially increasing the success of free flap salvage rates. Also, this method cannot be used to replace the clinical monitoring, but can be used as an adjunct, especially in teaching institutions to facilitate real time evaluation of free flap by operating surgeons to reduce the observational bias by the residents or nurses.

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Conflicts of interest - There are no conflicts of interest.

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