The Journal of Laryngology & Otology (2011), ***125***, *199–203*.
© JLO (1984) Limited, 2010
doi:10.1017/S0022215110001957

SHORT COMMUNICATION

Fixation of nasal bone grafts with interosseous wire: our technique

N SATHE, N GAIKWAD, G WADKAR, S THAKARE

Department of ENT, Seth G S Medical College and King Edward Memorial Hospital, Parel, Mumbai, India

Abstract

Background: The use of interosseous wire to fix bone grafts is well known. Herein, we describe a technique for fixation of an iliac crest bone graft for nasal augmentation, using a stainless steel wire.

Method: A hole in the cancellous part of the graft guides the wire exactly into a groove in the cortical part, preventing slippage and ensuring rigid fixation. The wire is then threaded through a hollow spinal needle passed underneath the skin envelope; this avoids a dorsal incision and thus minimises scarring, reduces the risk of graft exposure and improves the aesthetic result.

Results: This technique has two distinct advantages: prevention of wire slippage and avoidance of a dorsal nasal incision.

Conclusion: The described method uses an interosseous wire for rigid bone graft fixation, without a dorsal incision. This prevents wire slippage; it also achieves a good cosmetic result by improving the nasal contour via a cantilever effect which raises the nasal tip.

Key words: Technique; Nasal Bone Graft Fixation; Interosseous Wire

Introduction

Contour defects of the nose which require dorsal augmentation are seen in patients with septal collapse following submucous resection, post-traumatic defects and congenital deformities. Dorsal augmentation can be performed using alloplastic implants, cartilage grafts or bone grafts. However, the material used for augmentation needs either a structural support or a stable bed to rest upon. For this reason, depressions arising following submucous resection are difficult to correct, as structural support is missing in the lower half of the dorsum. In such cases, the lack of structural support can be easily diagnosed, as the supratip area sinks when pressed by the examining finger (Figure 1). A bone graft fixed at the upper end is a reasonable solution for these deformities.

Graft fixation plays an important role in the final cosmetic outcome. Along with internal shaping, it controls the position of the graft and maintains a good alignment. It has been proven that, in order to decrease the risk of resorption, the fixation must be rigid with good bone-to-bone apposition.[1–7] Furthermore, the recipient site should be immobile and should provide a good blood supply and some functional stress to the graft.[8]

Technique

The technique described below highlights the importance of preparation of the recipient site and graft, and also the importance of graft fixation.

Recipient site preparation

The graft site is prepared as follows. Bilateral alar rim incisions are made, through which the skin and soft tissue envelope of the nose is degloved. Once the inferior edge of the nasal bones is reached, subperiosteal undermining is performed up to and slightly beyond the nasofrontal angle, so that the implant can be easily inserted up to that site and then manipulated in a retrograde fashion towards the nasal tip. The bony dorsum is rasped to remove the remaining periosteum and the superficial layer of bone, thus enabling bone-to-bone contact.

Shaping the graft

The bone graft is harvested from the iliac crest. This cortico-cancellous iliac crest graft is carved such that the cortex is preserved on one side (the dorsal side) while the cancellous side is shaped to fit the defect, using a number 10 scalpel. The boat-shaped graft should extend up to the tip; depending on the nasal length, it will be approximately 4–4.5 cm in length, 4–6 mm in width and 3–4 mm thick at the site where wire fixation is to be performed (5–10 mm inferior to the nasofrontal angle). At the wire fixation site, a groove is made on the anterior cortical aspect of the graft. Just below this groove, a parallel hole is bored into the cancellous portion using a 20 gauge needle (Figure 2).

The sculpted and prepared graft is inserted into the previously created nasal pocket to test its shape and stability. Cephalad pressure is applied in the radix area to replicate the eventual fixation and to enable assessment of cosmesis. Any additional modifications to the graft can be made at this time.

Graft fixation

A small stab incision is made in the right medial canthal region and a hole is drilled using a hand drill with a 16

Accepted for publication 4 May 2010 First published online 1 October 2010

https://doi.org/10.1017/S0022215110001957 Published online by Cambridge University Press



FIG. 1
'Digital palpation test' demonstrating lack of structural support for nasal septum.

gauge spinal needle attached in lieu of drill bit (Figure 3). The needle passes through the nasal bones and exits the skin at the opposite medial canthus. A 26 gauge, pre-stressed stainless steel wire, approximately 25 cm long, is then threaded through the needle while the needle is withdrawn slowly (Figure 4).

The spinal needle is inserted underneath the skin envelope through the right side of the rim incision to the left medial canthal region. The leading end of the wire is guided

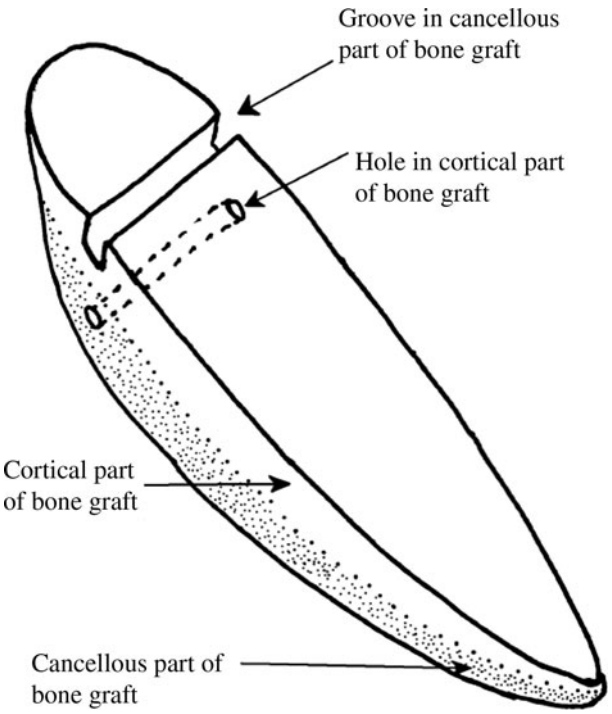


FIG. 2
Diagram of the bone graft.

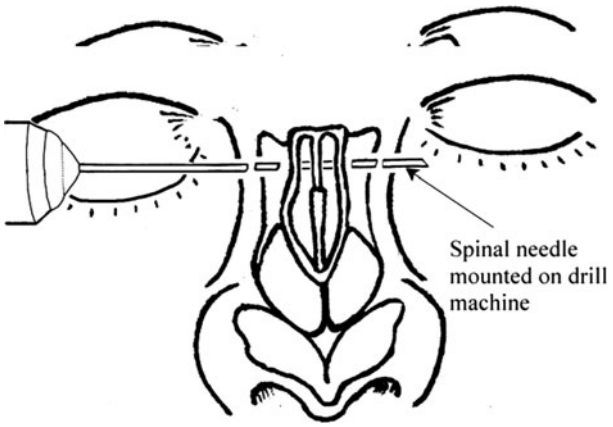


FIG. 3
A hole is made with a spinal needle mounted on a hand drill.

through the spinal needle so that it emerges through the rim incision on the right side of the columella (Figure 5). The graft is then mounted onto the wire by passing the wire through the hole in the cancellous bone; the wire is then bent and passed over the groove on the anterior cortical surface (Figure 6). The spinal needle is bent to a minimum curvature and again passed from the stab incision in the right medial canthal region to the right alar rim incision, and the wire guided through it (Figure 7).

The wire is slowly pulled through the medial canthal stab incision. Both ends of the wire are gradually pulled as the graft is inserted into the pocket and positioned on the nasal bone (Figure 8a). The bevelled graft tip projects beyond the nasal bones, providing tip projection. The wire is then tightened, putting stress on the graft, in order to ensure adequate graft fixation, and the cut ends are buried in the soft tissue in the medial canthal region (Figure 8b).

Wound closure and splintage

The stab incisions do not require suturing. The rim incision is sutured with 4/0 absorbable suture thread.

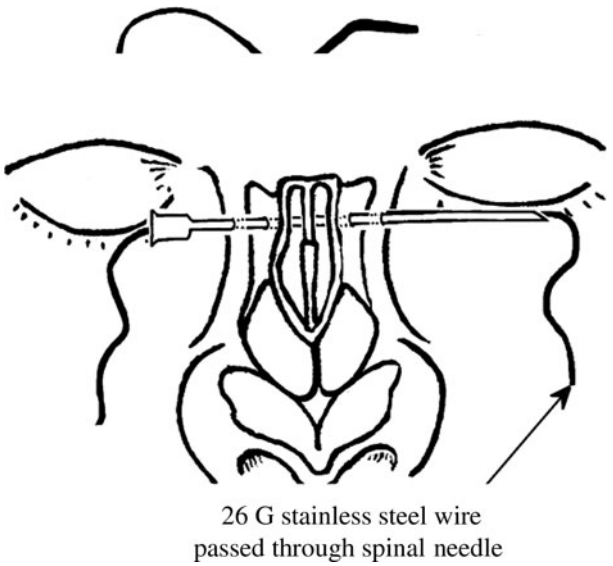


FIG. 4
A 26 gauge stainless steel wire is passed through the spinal needle.

https://doi.org/10.1017/S0022215110001957 Published online by Cambridge University Press

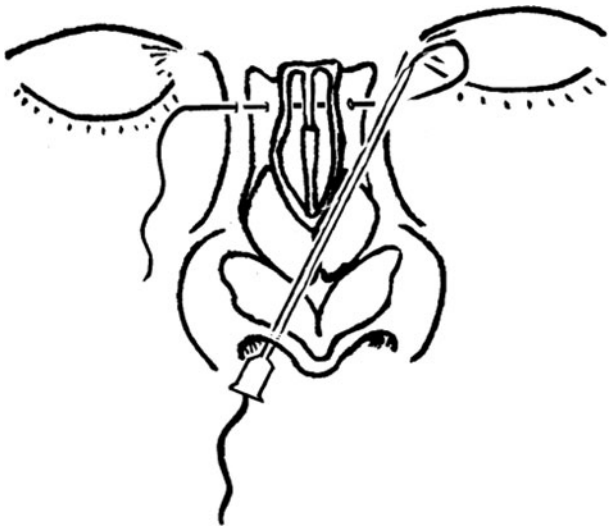


FIG. 5
The leading edge of the stainless steel wire is brought out through the alar rim incision.

The nose is taped and a plaster of Paris splint is placed on the nose for protection and to reduce the risk of haematoma. The splint is removed after three weeks.

Results

This technique has thus far been used in 16 patients with post-supratip depression after submucous resection. The first 10 patients were followed up for five years. During this time, augmentation was maintained and a straight dorsal line persisted. Routine plain X-rays showed no resorption of bone (Figure 9). The remaining six patients have been followed up for shorter periods (ranging from four months to two years), but no contour changes have been observed thus far.

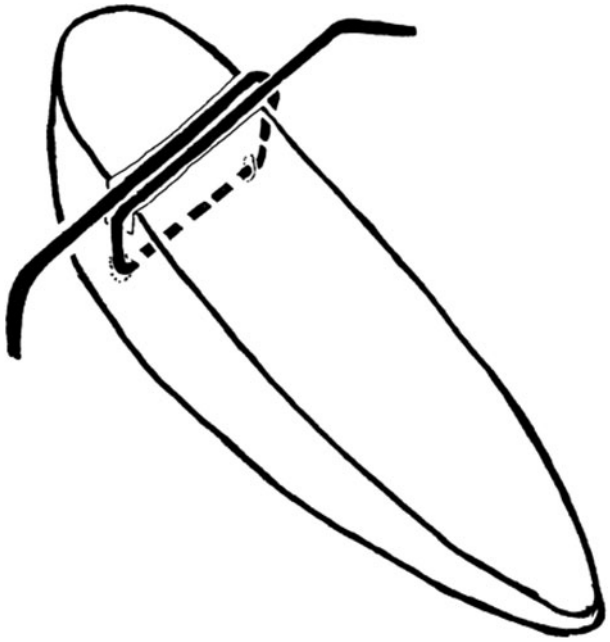


FIG. 6
The bone graft is mounted on the stainless steel wire.



FIG. 7
The leading edge of the stainless steel wire is brought out through the medial canthal stab incision.

In all these patients, we were able to achieve the desired aesthetic result by correcting the deformity and establishing a pleasant nasal profile (Figure 10). As the graft projects beyond the nasal bones, the resulting cantilever effect raises the nasal tip (Figure 11).

The graft wire was not palpable in any of the cases undertaken, and there has been no apparent fatigue of the wire with time. No post-operative infection was encountered; however, all patients received broad-spectrum antibiotics for two weeks post-operatively.

Discussion

Nasal supratip depression following submucous resection presents a specific challenge, as there is little structural support available for materials used to augment the cartilaginous part of the nose (i.e. the middle and lower third). Because of this, authors have advocated either a bone graft fixed at one end or an L-shaped graft or implant.[1] However, implants are at risk of extrusion, especially in scarred and previously operated-upon noses.[2,3,9–12]

Various methods have been described for graft fixation, using lag screws, mini-plates and screws, interosseous wiring, and K wires. However, these techniques are complicated and time-consuming, and have the potential for failure due to early malposition, late resorption or poor restoration of normal nasal contour.

Kirschner wires or 30 gauge needles can be passed percutaneously through the bone graft and into the nasal bones, but removal in the early post-operative period leads to malposition and non-union. Thus, K wires are usually used along with another method of fixation.[3,6,9] Ultra-mini-screws and plates produce rigid fixation but require an incision in the dorsal skin for insertion, and the screws may occasionally be palpable in the frontonasal region.[2,6] Lag screws have been used for cantilever grafts; however, a single screw does not provide rigid fixation as rotation around this screw is possible. Bone is also prone to micro-fractures and horizontal cracking as the screw tightens, and if the head is

https://doi.org/10.1017/S0022215110001957 Published online by Cambridge University Press

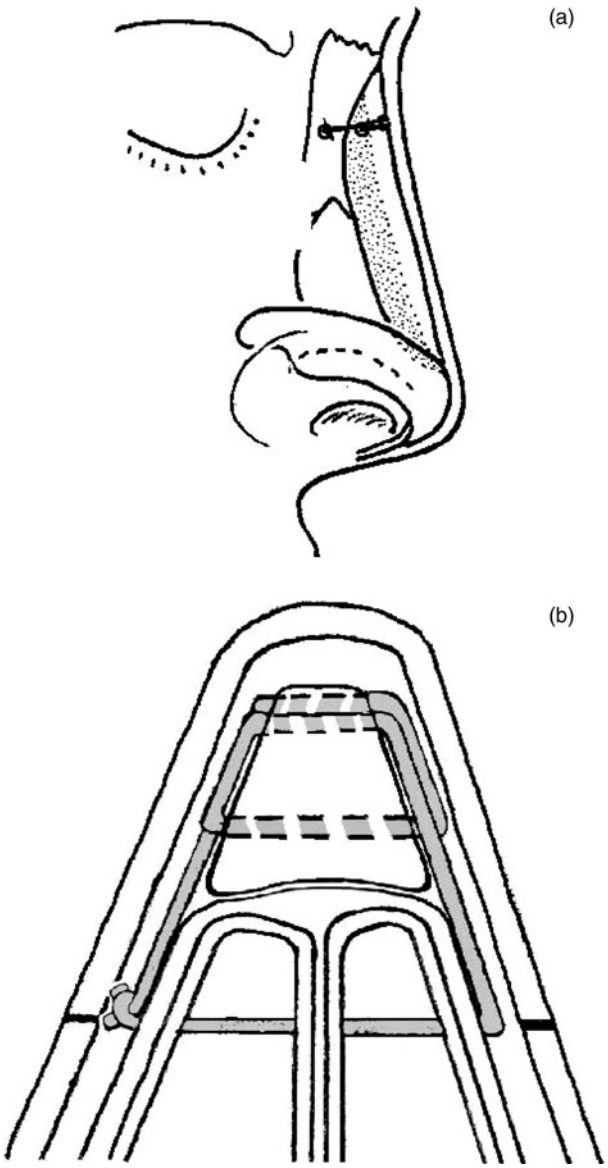


FIG. 8
The bone graft in situ: (a) profile view, (b) transverse section.

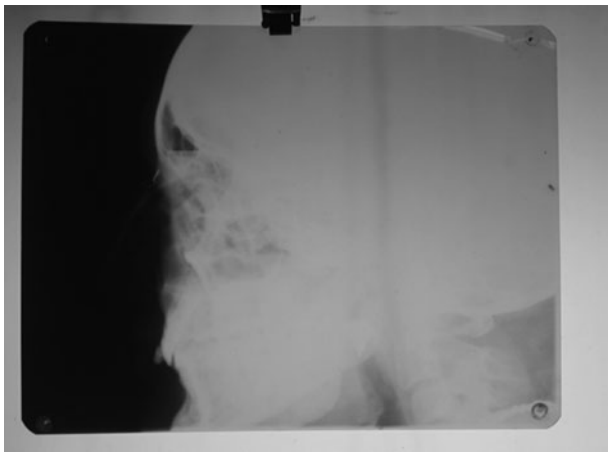


FIG. 9
X-ray showing no bone resorption after three years.

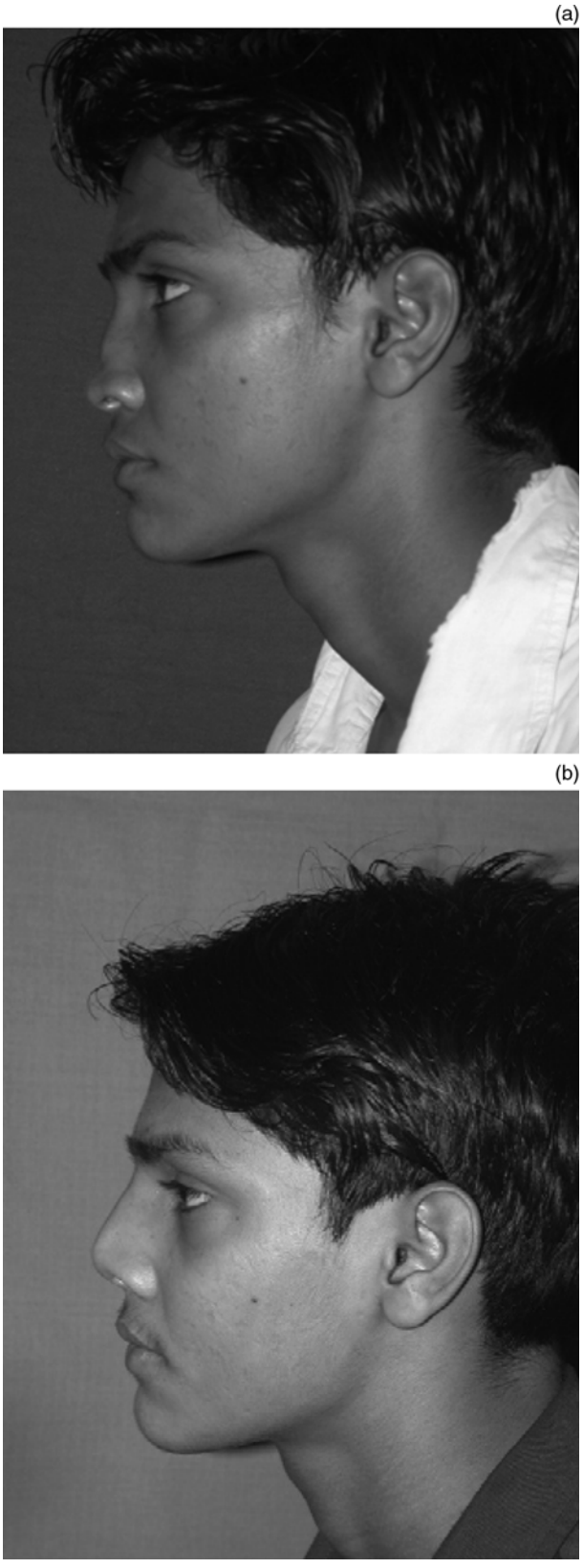


FIG. 10
Profile photographs: (a) pre-operative, (b) post-operative.

countersunk this weakens the bone. There is also a risk of entry into the nasal cavity.[4]

The use of interosseous wire for fixation has been previously described but details of the technique are lacking.

https://doi.org/10.1017/S0022215110001957 Published online by Cambridge University Press

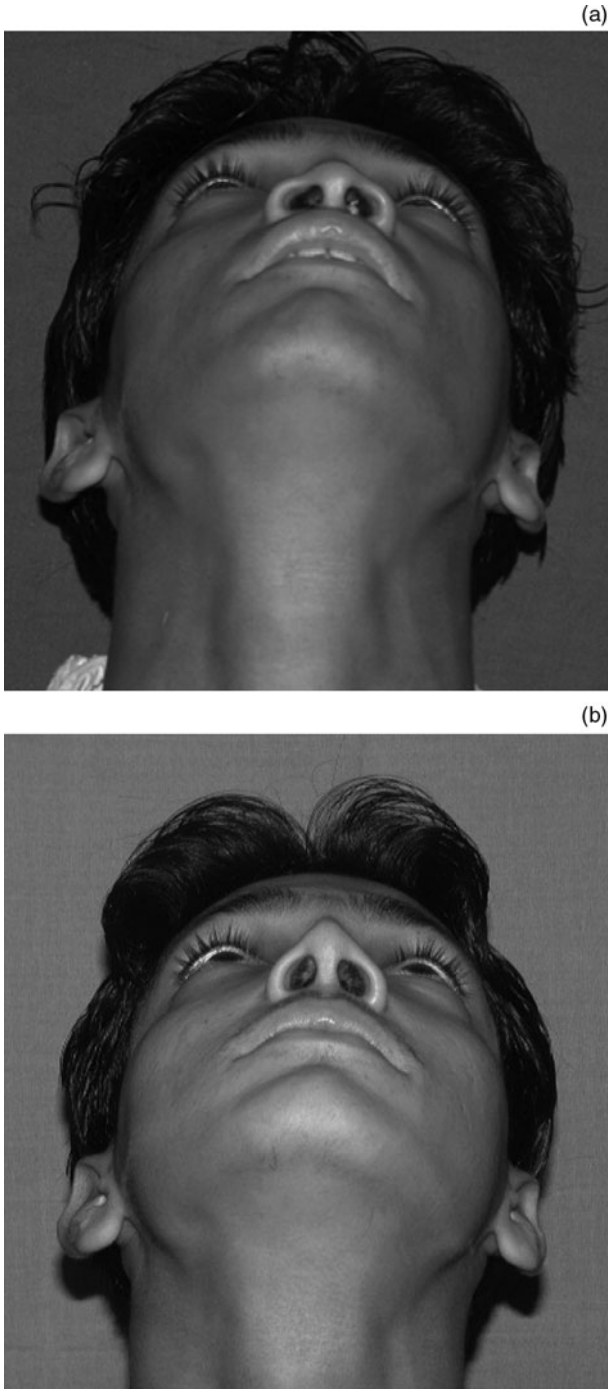


FIG. 11
Basal or 'worms-eye' view photographs: (a) pre-operative, (b) post-operative. The cantilever effect of the bone graft raises the nasal tip.

Without a dorsal skin incision, it is extremely difficult to guide a wire percutaneously from one canthal region to the other over a bone graft and to make it sit exactly.[9] If a dorsal incision is made to expose the nasal bones this facilitates passage of the wire, but it may also result in increased scarring, greater risk of graft exposure and an inferior cosmetic result.

Our method of graft fixation uses interosseous wiring but avoids the need for a dorsal incision by entangling the graft in the wire and by threading the wire through a hollow needle. The graft has a parallel hole beneath a groove, ensuring that the wire sits exactly as intended. As the wire is bent over into the groove, the brunt of compressive forces is borne by the strong cortical bone, thus preventing the wire from cutting through the graft. This rigid fixation of the bone graft allows better 'take'.

Calvarial bone grafts are superior in terms of lack of resorption but have restricted possibilities as regards graft shaping.[5,8,13,14] The iliac crest provides an abundant source of cortico-cancellous bone graft, and the graft can be surprisingly easily carved with a scalpel and sculpted into the desired shape and contour. It can also be polished with a number 15 blade to make the dorsum smooth. Unfortunately, resorption is unpredictable, leading to loss of shape and volume. However, this can be prevented by rigid fixation and good bone-to-bone apposition. We feel our method offers this, and provides satisfactory results without other complications related to donor site morbidity.

Acknowledgement

We are thankful to our Dean and Director Medical Education (ME) and Municipal Hospitals (MH), Dr Sanjay Oak, for permitting us to publish this paper.

References

1 Sullivan PK, Varna M, Rozzelle AA. Optimizing bone-graft nasal reconstruction: a study of nasal bone shape and thickness. *Plast Reconstr Surg* 1996;**97**:327–35
2 Posnick JC, Seagle MB, Armstrong D. Nasal reconstruction with full-thickness cranial bone grafts and rigid internal skeleton fixation through a coronal incision. *Plast Reconstr Surg* 1990;**86**:894–902
3 Wheeler ES, Kawamoto HK, Zarem HA. Bone grafts for nasal reconstruction. *Plast Reconstr Surg* 1982;**69**:9–18
4 Gruss JS. Cantilever nasal bone grafting with miniscrew fixation. *Plast Reconstr Surg* 1989;**84**:1014–15
5 Daniel RK. Rhinoplasty and rib grafts: evolving a flexible operative technique. *Plast Reconstr Surg* 1994;**94**:597–609
6 Neu BR. Segmental bone and cartilage reconstruction of major nasal dorsal defects. *Plast Reconstr Surg* 2000;**106**:160–70
7 Phillips JH, Rahn BA. Fixation effects on membranous and endochondral onlay bone graft resorption. *Plast Reconstr Surg* 1988;**82**:872
8 Smith JD, Abramson M. Membranous versus endochondral bone autografts. *Arch Otolaryngol* 1974;**99**:203
9 Stuzim JM, Kawamoto HK. Saddle nasal deformity. *Clin Plast Surg* 1988;**15**:83
10 Baser B, Shahani R, Khanna S, Grewal DS. Calvarial bone grafts for augmentation rhinoplasty. *J Laryngol Otol* 1991;**105**:1018–20
11 Tessier P. Autogenous bone grafts taken from the calvarium for facial and cranial applications. *Clin Plast Surg* 1982;**9**:531
12 Jackson IT, Smith J, Mixter RC. Nasal bone grafting using split skull grafts. *Ann Plast Surg* 1983;**11**:533
13 Zins JE, Whitaker LA. Membranous versus endochondral bone: implications for craniofacial reconstruction. *Plast Reconstr Surg* 1983;**72**:778
14 Tessier P. Fixation of nasal bone graft with interosseous wire: our technique. *Clin Plast Surg* 1981;**8**:279

Address for correspondence:
Dr Nilam Sathe,
Yash Co-Op Society,
66/1748, Kannamwar Nagar No 2,
Vikhroli (E),
Mumbai 400083, India

E-mail: drneelam_s@yahoo.co.in

Dr N Sathe takes responsibility for the integrity of the content of the paper
Competing interests: None declared

https://doi.org/10.1017/S0022215110001957 Published online by Cambridge University Press