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Single incision technique for two-point fixation of zygomaticomaxillary complex fractures

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ABSTRACT

Objective: The aim of this study is to discuss the Y modification of transconjunctival approach in the management of zygomaticomaxillary complex (ZMC) fractures.

Study design: 10 patients with unilateral ZMC fractures were included in this study. All patients were treated by two-point fixation through single incision by the Y modification of transconjunctival approach. The average follow up period was 6 months. The adequacy of exposure, cosmetic outcomes, intraoperative, and postoperative complications were evaluated.

Results: The exposure was excellent in all patients with good cosmetic outcomes. None of the patient had any intraoperative complications; postoperatively, one patient had mild displacement of lateral canthus and other had mild hyperpigmentation of scar.

Conclusion: The transconjunctival Y modification is a relatively new technique and provides excellent exposure and good esthetics. Yet, studies on large cohort needed to use this approach in the routine management of ZMC fractures.

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1. Introduction

The zygomaticomaxillary complex (ZMC) is the second common fracture of facial bones next to nasal bones.[1,2] The most prominent location in face make it more susceptible to trauma incidence. The ZMC fractures can significantly alter the appearance and function of the midface and orbit. Treatment varies from simple observation to open reduction and internal fixation with or without bone grafts based on the severity of the fracture. Surgical treatment is warranted in the presence of displacement, instability, or comminution of the involved bony fragments. There is a constant search for incision, which provide adequate exposure, excellent esthetics with minimal surgical morbidity.

Conventionally, subciliary, subtarsal, supratarsal, infraorbital, and lateral eyebrow incisions are being used in the management of ZMC fractures. Bourquet[3] in 1924 first described transconjunctival incision for removal of herniated orbital fat. In 1970, Tenzel and Miller[4] used transconjunctival approach for management of orbital floor fractures. As early as 1979, McCord and Moses[5] described the addition of the lateral

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canthotomy to gain access to the zygomatic frontal buttress. Martinez and Bradrick[6] modified the transconjunctival approach with a cutaneous Y-incision and lateral canthotomy for two-point fixation in frontozygomatic and infraorbital regions in ZMC fractures. Thus, this study aims to discuss the efficacy, advantages, and complication of Y-modification of transconjunctival approach.

2. Materials and methods

Helsinski ethical principles for medical research were strictly followed and approval from Institutional ethical committee was obtained. This is a prospective study conducted at The Tamilnadu Government Dental and College and Hospital in Chennai, India from February 2014 to April 2014, consisting of 10 unilateral zygoma fractures. A written consent was obtained from all the patients explaining the procedure. The trauma was due to RTA in eight patients, assault in one patient, and sports injury in the other.

Unilateral ZMC fractures without any ophthalmic and neurologic injury were included in the study. Medically compromised patients, patients having any pathology, or deformity of eye were excluded from the study. After eliciting a detailed history, a complete clinical examination and evaluation of CT scans was done and 10 patients who met the criteria were randomly selected. All patients were treated by two-point fixation in frontozygomatic and infraorbital region with titanium mini plates through transconjunctival Y modification approach.

Patients were followed up for an average period of 6–12 months. Postoperative submentovertex view and paranasal sinus views were taken within a week of surgery to assess the fracture reduction. Fracture stability was confirmed by taking CT scans 3 months after surgery. The scar assessment was done after 6 months of surgery; the scar was evaluated by four persons (two oral and maxillofacial surgeons and two non-medical personnel) and the scar was given a scale from 0 to 4 (0 Not visible; 1 Barely visible; 2- Noticeable; 3- Very noticeable; 4 Extremely noticeable).[7]

2.1. *Surgical anatomy*

The layers of lower lid include skin, subcutaneous tissue, orbicularis oculi muscle, orbital septum or tarsus, and conjunctiva. The lateral canthal tendon (LCT) is a fibrous extension of tarsal plates laterally toward the orbital rim. The LCT is Y-shaped and the two arms are attached to the external angle of the upper and lower tarsi. The base of the LCT has two components, superficial and deep. The thicker and stronger deep component of the LCT courses posterolaterally, inserting into the periosteum of the orbital tubercle of the zygoma, approximately 2–3 mm posterior to the orbital rim. The superficial bundle runs under the orbicularis muscle and continues over the frontal process, and it attaches to its periosteum and to the temporal aponeurosis.[8] This superficial bundle of LCT is detached during lateral canthotomy for gaining access and then it is sutured back to the hole in the bone in the same region.

2.2. *Surgical procedure*

All patients were treated under nasoendotracheal intubation. After preparing and draping the patient, corneal protectors with ophthalmic lubricant were placed. Two silk sutures were passed through the lower eyelid for retraction, which will also serve as frost sutures at the end of the surgery. A cutaneous Y-shaped incision was marked and made in the lateral canthal region along the skin crease (Fig. 1a and b). Conjunctival incision was made 2 to 3 mm from lateral commissure, extending medially just lateral to the punctum. The transconjunctival and the lateral canthal incision were connected. In lateral canthal region, the lower eyelid flap was retracted down by cutting the superficial LCT and inferior limb of deep LCT with fine scissors. Dissection was carried between the orbicularis oculi muscle and orbital septum till the periosteum of the inferior orbital rim. The lateral aspect of the upper eyelid was retracted superiorly, and lateral orbital periosteum was exposed. Now, the periosteum is incised and dissected subperiosteally to expose the inferior orbital rim, the orbital floor, and the lateral orbital rim. On retracting the corners, the cutaneous 'Y' will transform into a box allowing accessibility to the frontozygomatic and infraorbital rim through a single incision (Fig. 2a). The zygoma was reduced by inserting Rowes zygomatic elevator posterior to the lateral orbital rim and the fractures were reduced. Two-point fixation was done in frontozygomatic region and infraorbital region with titanium miniplates (Fig. 2b). Intraoperatively, the stability of fragments were confirmed, LCT resuspended to its original position with

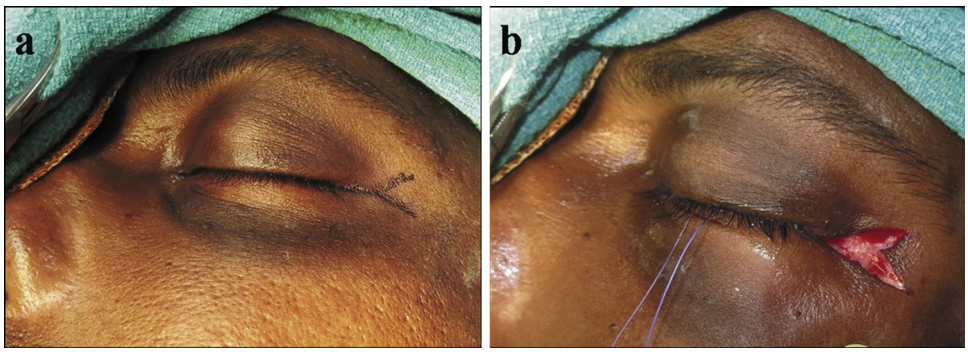


Fig. 1 – (a) Y-shaped incision marked in lateral canthus region. (b) Skin incision placed.

Table 1 – Age/sex distribution, etiology, surgical exposure and complications.

S. no.	Age	Sex	Mode of injury	Average time for exposure (min)	Exposure	Complications
1.	23	Male	Hit by ball	18	Excellent	None
2.	29	Male	RTA	19	Excellent	None
3.	30	Male	Assault	22	Excellent	None
4.	18	Male	RTA	19	Satisfactory	Hyperpigmentation of scar
5.	23	Male	RTA	17	Excellent	None
6.	35	Female	RTA	16	Excellent	None
7.	30	Male	RTA	19	Excellent	None
8.	40	Female	RTA	20	Satisfactory	Mild displacement of lateral canthus
9.	35	Male	RTA	18	Satisfactory	None
10.	40	Male	RTA	17	Excellent	None

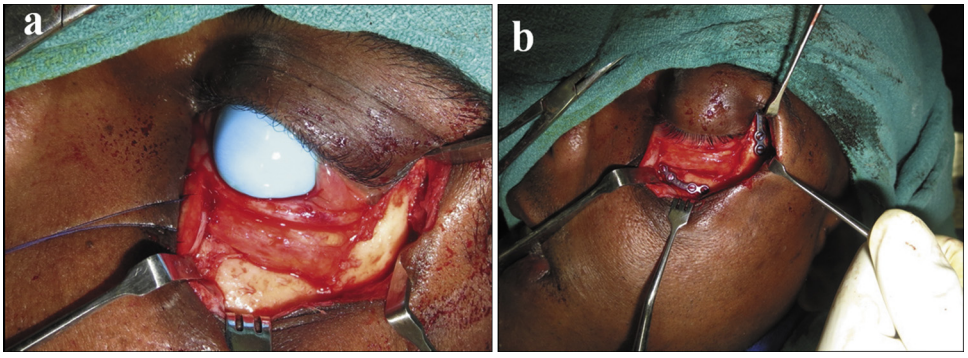


Fig. 2 – (a) Exposure of fracture site through single incision. (b) Fixation with miniplates.

prolene suture material, and layerwise suturing done. Frost sutures were placed for a minimum of 3 days.

3. Results

Ten patients underwent two-point fixation of ZMC fractures through transconjunctival Y modification. Patients age ranged from 18 to 40 years (mean 30.3 years). Table 1 shows age, sex distribution, etiology, and complications of all patients in this study. The surgical exposure and access was excellent in all cases for adequate reduction and fixation. Postoperative submentovertex and paranasal sinus views taken within a week of surgery confirmed that the fractures were adequately reduced. The CT scans taken after 3 months revealed that the fracture reduction was stable. All the patients had satisfactory facial symmetry and no functional impairment. Fig. 3a and b shows the preoperative and postoperative frontal view and Fig. 4a and b shows the CT scan axial views before and after fracture fixation. In particular, none of the patients had any visual complications like diplopia, enopthalmos, or alteration of visual acuity. One patient had displacement of the lateral canthus, but it was so mild that it was not noticeable to the patient. Table 2 shows the mean scar score and found to be excellent in most of the patients; one patient had mild hyperpigmentation of scar, which will eventually reduce over time.

4. Discussion

Treatment of ZMC fractures are most commonly carried surgical procedure in oral and maxillofacial surgical practice. The horizontal and vertical buttress of the ZMC and orbital floors should be aligned properly during surgery, to avoid postoperative complications like enopthalmos, diplopia, rotational zygomatic displacement, midface widening, and orbital dystopia. Incisions play a vital role in fracture exposure for adequate restoration of anatomic form and habitual function. Properly planned incisions provide good esthetics and prevent late complications.

The transconjunctival Y modification is a relatively new technique; when the lateral canthal ligament is mobilized both the fractures in the frontozygomatic and infraorbital rim can be visualized simultaneously, thus accurate reduction confirming alignment of the zygoma and the integrity of the greater wing of the sphenoid can be achieved. The zygomaticosphenoid suture can be clearly visualized, which is considered to be a critical area to assess the fracture reduction. By proper retraction of the cutaneous Y incision, body of zygoma can also be visualized, which is otherwise possible only with the coronal incision. Transconjunctival approach can be either preseptal or retroseptal. Preseptal approach avoiding the orbital fat is preferred for fracture reduction and fixation.



Fig. 3 – (a) Preoperative appearance – frontal view. (b) Postoperative appearance – frontal view.

Thus, in our series preseptal approach was used for all patients.

The average time taken for transconjunctival Y modification in this study was 18.50 minutes, which is similar to the study conducted by Holtmann et al.[9] Though the time taken for incision is more compared to standard infraorbital incision, esthetics is better with this approach and only single incision is made which eventually reduces the total time taken for surgery. The fracture reduction and stability was good in all cases evaluated by radiograph and CT scans (Fig. 5).

The average scar score was found to be excellent in most cases. In one case the scar was noticeable due to hyperpigmentation, which we believe will eventually reduce over time. One patient had mild displacement of the lateral canthus. The displacement was very mild that it did not require a revision surgery. When compared to the cutaneous incisions in infraorbital and frontozygomatic region, the length of the scar is very small in the lateral canthus region. Also the Y incision was placed in the periorbital wrinkles, which fan out across the skin from the outer corner (lateral canthus) of each eye, concealing the scar.

Table 2 – Individual and average scar scores evaluated at 6 months postoperatively.

S. no.	Observer				Average
	1	2	3	4	
1.	1	1	0	0	0.5
2.	1	1	0	0	0.5
3.	1	1	0	0	0.5
4.	3	2	1	1	1.75
5.	1	1	0	0	0.5
6.	1	1	0	0	0.5
7.	1	1	1	1	0.5
8.	2	2	1	1	1.5
9.	1	2	1	1	1.25
10.	1	1	0	0	0.5

Score : 0 - Not visible; 1- Barely visible; 2 Noticeable; 3 - Very noticeable; 4 - Extremely noticeable. Average scar score: 0-0.9 - Excellent; 1-1.9 - Satisfactory; 2-2.9 - Poor; 3-4 - Very poor.

The common complications with lower eyelid incision are lid ectropion, entropion, lateral canthal displacement, sclera show, injury to the globe, and cicatricial scarring. Globe was properly protected with plastic corneal shield, thus none of the patients had any globe injuries like corneal abrasion. A meta-analysis published recently has established that the incidence of ectropion after placing transconjunctival incision is 1.5% compared with 3.8% for a subtarsal incision and 14% for subciliary incision.[10] The use of the transconjunctival incision in this study did not result in postoperative ectropion in any of the cases. The absence of ectropion in this study may be entirely secondary to either the small cohort used in this study or the relatively young age of the patients in whom the lower eyelid laxity would be less prevalent. The repositioning of the LCT is a more demanding procedure requiring experience and it is difficult for the beginners. If the LCT is not properly sutured back to position, it may lead to displacement of the lateral canthus and sclera show. In this study the LCT was properly repositioned and frost suture was placed at the end of the surgery and maintained for 2 days postoperatively for all patients. We believed that the frost suture produced superior traction, which encourages the lower eyelid redraping in proper anatomic position. Another common complication reported is entropion, probably determined by the level at which the incision is placed. The transconjunctival incision should be placed just below the inferior margin of the tarsal plate. Wray et al.[11] reported that the entropion might be due to

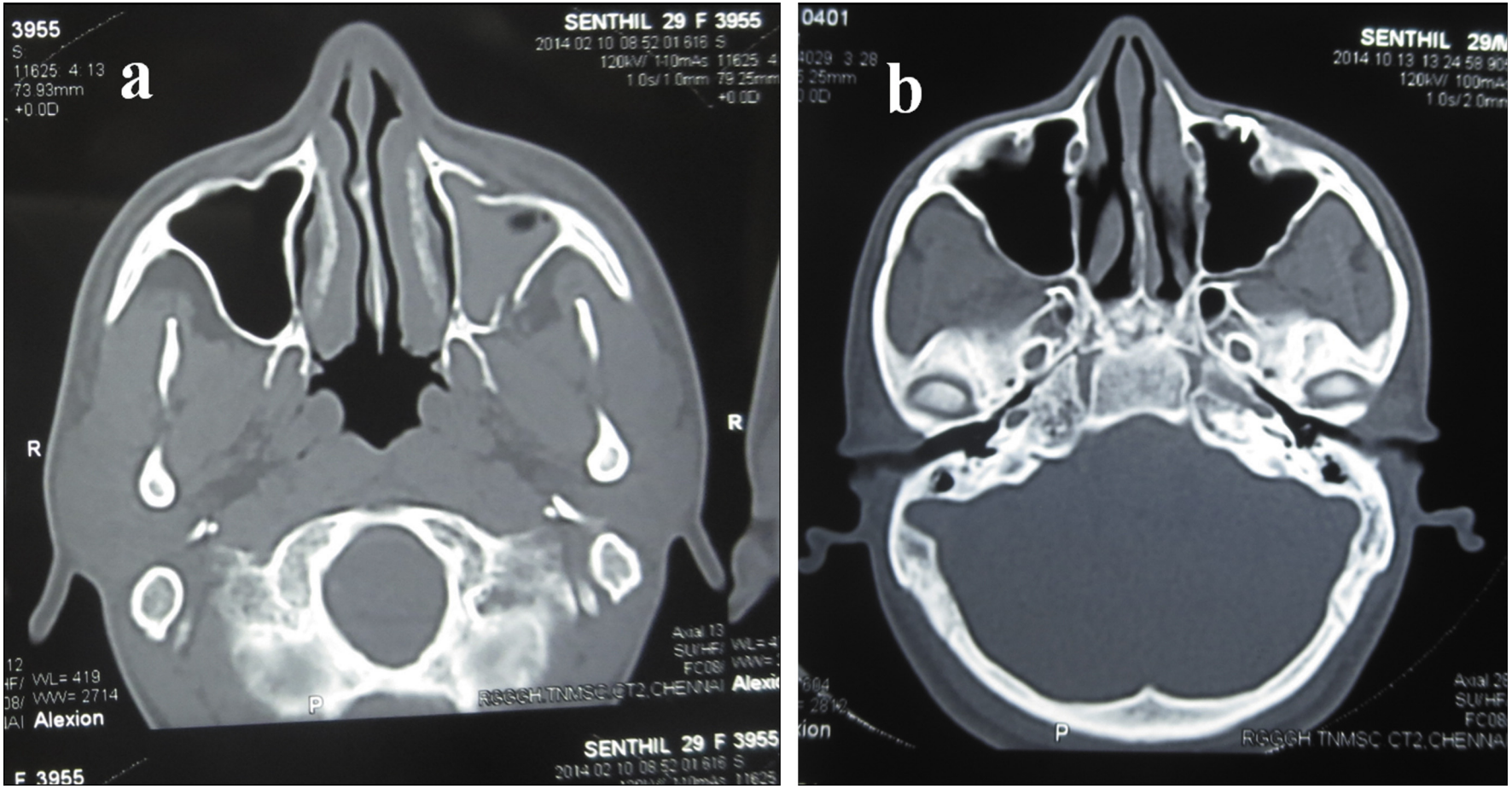


Fig. 4 – (a) CT scan – axial view – preoperative. (b) CT scan – axial view – postoperative.

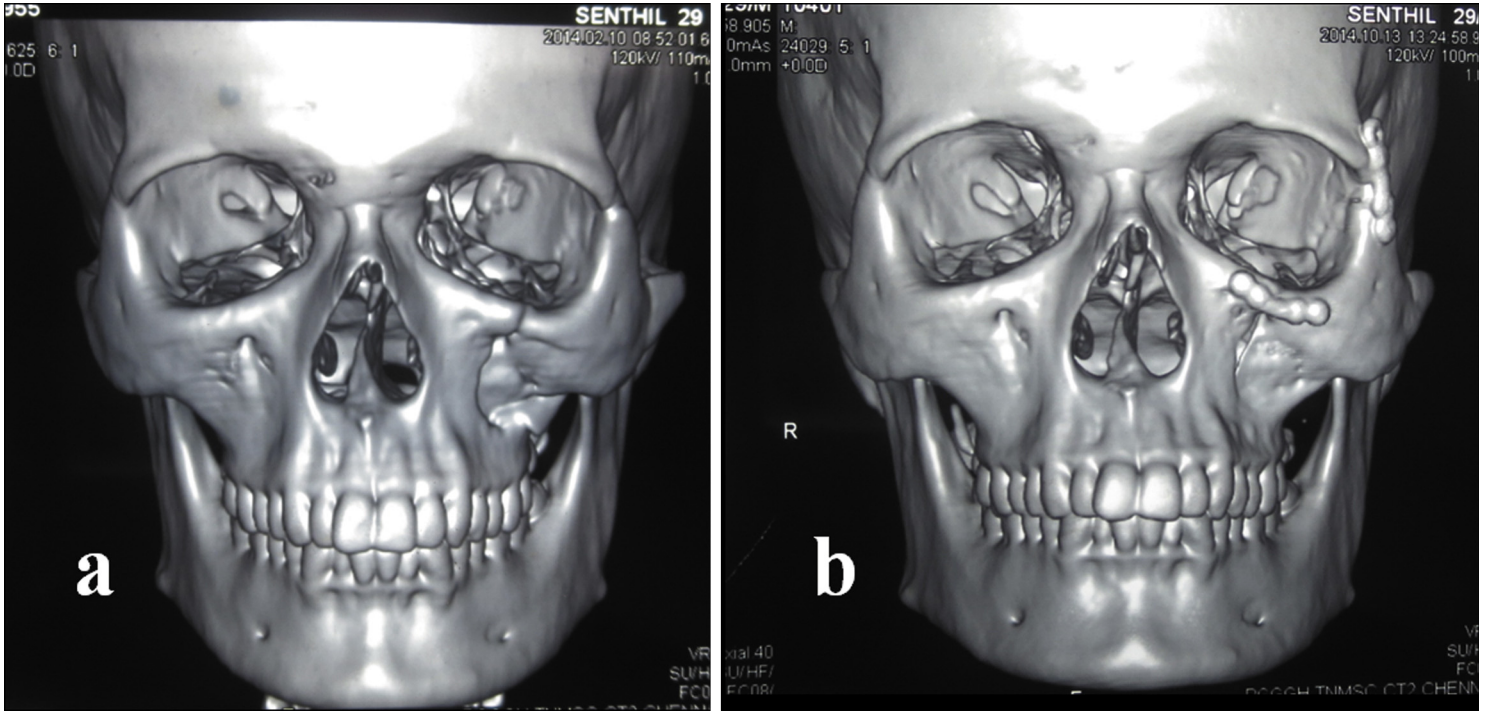


Fig. 5 – (a) CT scan – 3D reconstruction – preoperative. (b) CT scan – 3D reconstruction – postoperative.

the transconjunctival incision placed overlying the tarsal plate rather than in the inferior margin, so while suturing, the conjunctiva might have adhered to the tarsal plate which resulted in sutures catching the tarsal plates and causing a turning in of the lower lid causing entropion. He also suggested that the entropion resolved after removing the sutures. In this series entropion was not reported in any of the patients.

Neither the transconjunctival nor the transcutaneous approaches are immune from complications. Given that all approaches have the potential for postoperative sequelae, the approach selection should be customized according to the needs of each patient and should balance the perioperative risks with the requirements of treatment. The approach must also be based, in part, on the ability of the surgeon to not only perform the approach but also to manage the complications that might result.

5. Conclusion

No consistent approach for ZMC fractures has gained universal acceptance. The transconjunctival 'Y' modification approach provides excellent exposure and access, has minimal complications and also it is superior esthetically when compared with other approaches. The potential advantages of this approach outweigh the fact that it takes longer time to perform. The complications of this technique may be reduced if meticulously performed with sound knowledge of anatomy of periorbital tissues. In our experience, the transconjunctival 'Y' modification is most effective for two-point fixation through single incision. The only factor which is of concern is that this approach is technically demanding, need surgical expertise, and meticulous handling of the tissues.

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Ethical approval

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Written informed consent was obtained from all individual participants included in the study in their regional languages.

Conflicts of interest

The authors have none to declare.

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