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Research Article

Modification and Manufacturing of McCoy´s Facial Trisquare

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Abstract

This article reported the modification and home manufacturing of McCoy's facial trisquare, a diagnostic tool used in facial surgery, particularly for assessing orbital and periorbital asymmetries trans-surgically.

To address these issues, modifications were made to the original template, including the addition of a calibrated grid and reference lines to enhance visual discernment and accuracy during surgical procedures.

The modified template is designed for low cost, easy making, it accessible for clinical and surgical use. We emphasize the importance of reducing surgical complications and improving patient outcomes through precise anatomical positioning.

Furthermore, the modified McCoy's facial trisquare can be utilized in various measurements, underscoring its potential value in trauma and specialty in orthognathic surgery. Future research is suggested to further evaluate the effectiveness of this modified tool in clinical settings.

Keywords: *McCoy, facial, tri-square, diagnosis tool, manufacturing*

INTRODUCTION

The most precise method for measuring ocular protrusion has been debated since the development of the first exophthalmometer by Cohn in 1865. Most of these instruments, such as the Luedde, Mutch and Hertel exophthalmometers, have used the lateral orbital margins as a fixation base to measure the ocular protrusion, but the height of the eyeball and the periorbital structures could not be measured properly, in this sense Frederick McCoy [Figure 1] invented the facial trisquare [Figure 2a].

The instrument consists of a curved, clear-plastic plate with a central nasal cut-out, allowing it to fit on the patient's face; that can be used to measures eye height and intercanthal distances, but none of them measure the yaw and roll in the jaws and chin, Although McCoy only marks the midline towards the jaws.

The prominent position of the orbits on the facial skeleton makes them a frequent site of traumatic injury, with potentially profound implications on globe function and esthetics. As early as 1888, Lang postulated that the cause of these symptoms was enophthalmos resulting from an enlargement of the volume of the bony orbit.

McCoy’s facial trisquare a diagnostic tool useful for measuring and photographically documenting dystopia of the globe and canthi in relation to the midline and the cantal line [1,2]. to measure the height of the eyeball in enophthalmos [3,4], to obtain anthropometric values [5,6,7,8] and in facelift to reposition the canthal ligaments [9].

These measurements alone were, however, insufficient, and not objective enough to assess the malar prominence, where minor discrepancies are often readily apparent [10].

The McCoy's facial trisquare is a diagnosis tool create for Frederick McCoy, born in Kansas City, United State in 1936. He established a plastic surgery practice in Kansas City, Missouri in 1950 and was a professor at the University of Kansas City. He was President of the American Society of Plastic Surgery (ASPS) and a member of 53 related

associations. He was also the first craniofacial surgeon at Children's Mercy Hospital, where he founded the Cleft Clinic (1962) and the Craniofacial Malformations Clinic (1970).

With his philanthropic vision, after designing it facial trisquare, he released the patent so that its manufacture would be available to surgeons working in the facial region. He created a foundation with his wife to help children with craniofacial malformations.

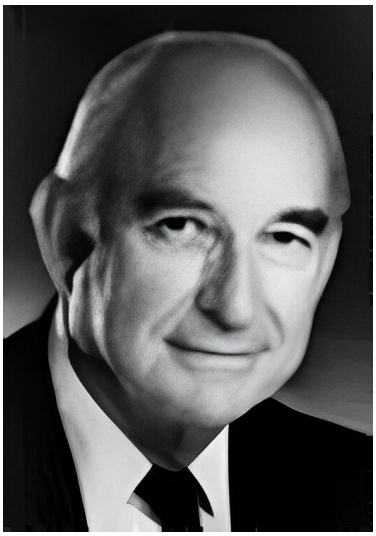

Figure 1. Dr. Frederick John McCoy (1916- 2006). AI-enhanced photography.

Despite the patent being released, few companies have produced it in plastic format, but production costs mean that it has a value that ranges from US$ 132 to US$ 204.

Despite 3D technologies and customized prostheses, facial surgeons are often confused during the transoperative phase of trauma surgeries, regarding the position of the eyeballs after fractures of the zygomatic bones, orbital walls and dystopias that may occur and the telecanthus in nasoorbitoethmoidal (NOE) fractures, as well as the position of the jaws and chin with respect to the midline in orthognathic surgery. With this last problem we considered adding some modifications to this template.

MATERIAL AND METHODS

Design and manufacture of the template

First, the frame for modificated McCoy's facial tri-square was made in the Word ™ program by Windows™. Inside this frame, the red midline was drawn along the entire length of the template (this is the main reference point for any measurement). The millimeter ruler (previously calibrated) was placed horizontally at the top and a vertical millimeter ruler was placed 35mm from both sides of the midline. A trapezoidal quadrilateral drawing was made.

Modification

We add a calibrated 2-millimeter grid (for better visual discernment) was placed in the Word™ template below the lower edge of the trapezoidal quadrilateral (nose area) and a red horizontal line was randomly placed with two vertical millimeter rulers calibrated at the ends, the first one was 35 millimeters away and a second vertical ruler was placed 60 millimeters away from the midline. In addition, two vertical reference lines 10 millimeters from the center line on the grid and the midline redrawn in red.

Printing and Laminating

After obtaining the McCoy facial tri-square template, the template is printed with 8.5 x 11 Inch transparent acetate paper and compatible with all popular inkjet printers.

The edges of the template are cut out with scissors and the hole of a trapezoidal quadrilateral (nose area) with a knife.
This acetate model is laminated with laminating sheets, 3 mil. thick and 9 x 11.5 inches in size, to finish the edges of the template are cut out with scissors and the nasal part with a knife. In this way a malleable device is finished, and the modified McCoy facial trisquare is obtained.

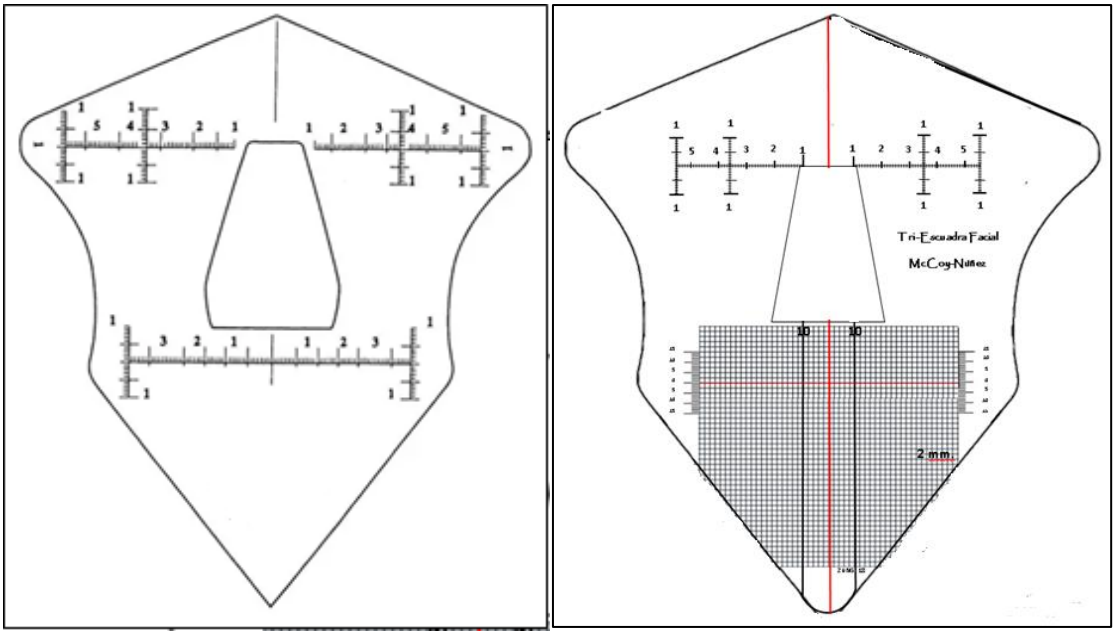

Figure 2. a) The original McCoy's facial tri-square template. b) our modifications.

This modified template which can be downloaded from the following web page made for this purpose: https://sites.google.com/view/facial-trisquare-mccoy-nunez/template; or scanning the following QR:

Use

This McCoy's facial tri-square is an intuitive diagnostic tool, where the potential error when using this device is the incorrect placement. At the time of use, at least two points in the midline of the soft tissues must be taken into account for fixing the appliance.

Place yourself in front of the patient if it is a clinical examination or behind him if it is a transsurgical examination, and hold the device with your left hand (or with the hands of the surgical assistant) and adjust it to the malar region, taking into consideration the following points on the midline. These may be, depending on the need, from top to bottom, the glabellar soft point (G'), the nasion soft (N'), the subnasal point (Sn), the upper labial philtrum (FILs), the stomion (St), the dental midline, and the lower labial (Li), and moving it from top to bottom without moving from the midline regardless of the adjustments that are necessary for the horizontal lines.

Discussion

In maxillofacial surgery, surgical planning involves a series of logical steps. These steps include data gathering, diagnosis and quantification of the condition, establishment of a preliminary surgical plan, surgical simulation, establishment of the final surgical plan, and transfer of the plan to the patient.

Data is gathered from a multitude of difference sources. They include the physical examination, medical photographs, plain x-rays (e.g., cephalogram, orthopantomogram), CT and mounted plaster dental models [11]. Each of these sources provides a portion of the whole data set that is needed for successful planning. In practice, a surgeon evaluates each one of these studies in a sequential manner and creates a complete 3D mental picture [12].

Maxillofacial trauma presenting to the emergency department (ED) are often accompanied with complex concomitant injuries, thereby making thorough diagnosis and treatment plan quite an exacting task owing to the demanding conditions of the ED.

The surgical correction of CMF deformities is among the most challenging. The success of these surgeries depends not only a larger extent, on the formulation of a precise surgical plan., but also, to on the technical aspects of the operation. The use of computer-aided design and custom implants is taking the guesswork out of plate bending and restoring the volume of the native orbit. Intraoperative navigation and intraoperative CT scanning systems have been introduced to help ensure anatomic plate positioning. Each of these technologies is doing its part to prevent complications and improve patient outcomes [13].

Despite its increasing use in craniofacial reconstructions, three-dimensional (3D) printing of custom orbital implants has not been widely adopted. Limitations include the cost of 3D printers capable of printing in a biocompatible material suitable for implantation into the orbit and the variety of implant materials available.

Three-dimensional modeling and printing are increasingly used in facial reconstructions, including the 3D printing of orbital implants. The benefit of such customized orbital implants is obviating the need for intraoperative adjustments and manipulation of tissue, thereby reducing collateral tissue damage, surgical times and hopefully by extension, improving clinical outcomes.

Sometimes the maxillofacial surgeon finds it necessary to operate on the patient urgently. Waiting longer than 2 weeks, 4 weeks, or more was clearly associated with an increased risk of the development of persistent diplopia and/or enophthalmos postoperatively [14].

As we have already seen, the applications of McCoy's facial tri-square are useful in the periorbital area. Sometimes, despite the imaging technologies and the manufacture of 3D prostheses and surgical guides, the surgeon can become disoriented in orthognathic and chin surgeries with respect to the midline, where this modification can be helpful in the trans-surgical process.

Conclusion

We can summarize that the McCoy's facial trisquare is used to measure and photograph: the intercanthal distance. the interpupillary distance, the height and width of the palpebral fissure. the vertical and horizontal dystopias of the eyeball, horizontal dystopias of the eyelid canthus and establish the dentofacial midline.

As we see, McCoy's facial trisquare measures none of them measure the yaw and roll in the jaws and chin, although McCoy's facial trisquare only marks the midline towards the jaws.

The modificated McCoy’s facial trisquare presented above demonstrate the feasibility and accessibility of low-cost and this template can be cold sterilized or oxide nitrous and used trans-surgically, independent use in orbital reconstructions and orthognathic surgery.

Our modification is made of laminated paper that is malleable and adapts to any facial contour and we can add the following uses: measure plate modifications in the grid for mentoplasty, establish the midline in mentoplasty, establish the horizontal position of the upper and lower occlusal midline and its establishes if there is no occlusal edge has a yaw or a roll. the way we have made it; any surgeon can make it at low cost.

This McCoy's facial tri-square is an intuitive diagnostic tool, where the potential error when using this device is the incorrect placement the two point at the midline. regardless of the adjustments that are necessary for the horizontal lines. Future research on this device will be required in the trans surgical areas of trauma and orthognathic surgeries to evaluate its usefulness.

References

1. Goldberg, R. A., & Shorr, N. (1993). The McCoy facial trisquare: a useful instrument for measuring dystopia of the globe and canthi. Ophthalmic Surgery, Lasers and Imaging Retina, 24(5), 355-356.
2. Kashkouli, M. B., Abdolalizadeh, P., Abolfathzadeh, N., Sianati, H., Sharepour, M., & Hadi, Y. (2017). Periorbital facial rejuvenation; applied anatomy and pre-operative assessment. Journal of current ophthalmology, 29(3), 154-168.).
3. Soliman, L., Sawicki, N., Sobti, N., Swartz, S., Rao, V., & Woo, A. S. (2023). Re-Evaluating the timing of surgery after isolated orbital floor fracture. Plastic and Reconstructive Surgery–Global Open, 11(5), e4973.
4. Kim, Yong-Ha; Ha, Ju-Ho; Kim, Tae-Gon; Lee, Jun-Ho. (2012). Posttraumatic Enophthalmos. Journal of Craniofacial Surgery, 23(4), 1005–1009. doi: 10.1097/SCS.0b013e31824e6a1a)

5. Antonyshyn, O., Gruss, J. S., Galbraith, D. J., & Hurwitz, J. J. (1989). Complex orbital fractures: a critical analysis of immediate bone graft reconstruction. Annals of plastic surgery, 22(3), 220-235.
6. Park, D. H., Choi, W. S., Yoon, S. H., & Song, C. H. (2008). Anthropometry of Asian eyelids by age. Plastic and reconstructive surgery, 121(4), 1405-1413.
7. Chen, M. C., Ma, H., & Liao, W. C. (2013). Anthropometry of pretarsal fullness and eyelids in oriental women. Aesthetic plastic surgery, 37, 617-624.
8. Burusapat, C., Thanapurirat, S., Wanichjaroen, N., Pruksapong, C., Attainsee, A., & Jankajorn, S. (2020). Anthropometry analysis of beautiful upper eyelids in oriental: new eyelid crease ratio and clinical application. Aesthetic Plastic Surgery, 44, 392-410.),
9. Hinderer, U. T. (1992). The sub-SMAS and subperiosteal rhytidectomy of the forehead and middle third of the face: A new approach to the aging face. Facial plastic surgery, 8(01), 18-32.).
10. Zingg, M., Leadrach, K., Chen, J., Chowdhury, K., Vuillemin, T., Sutter, F., ... & Eppley, B. L. (1993). Classification and Treatment of Zygomatic Fractures: A Review of 1, 025 Cases. Journal of Craniofacial Surgery, 4(3), 190.).
11. Bell WH, editor. Modern practice in orthognathic and reconstructive surgery. WB Saunders; Philadelphia: 1992.
12. Xia, J. J., Gateno, J., & Teichgraeber, J. F. (2009). New clinical protocol to evaluate craniomaxillofacial deformity and plan surgical correction. Journal of oral and maxillofacial surgery, 67(10), 2093-2106.
13. Jazayeri, H. E., Khavanin, N., Jason, W. Y., Lopez, J., Ganjawalla, K. P., Shamliyan, T., ... & Dorafshar, A. H. (2020). Does early repair of orbital fractures result in superior patient outcomes? A systematic review and meta-analysis. Journal of Oral and Maxillofacial Surgery, 78(4), 568-577.
14. Jazayeri, H. E., Khavanin, N., Jason, W. Y., Lopez, J., Ganjawalla, K. P., Shamliyan, T., ... & Dorafshar, A. H. (2020). Does early repair of orbital fractures result in superior patient outcomes? A systematic review and meta-analysis. Journal of Oral and Maxillofacial Surgery, 78(4), 568-577.

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