



Original Article

Time to Propose a New Classification for Midface Fractures on Changing Trends - A Fact to Accept

S. Ahamed Rafeeq Meeran¹, D. Gowthin², S. Raja³, V. Yamuna⁴, Dr. Felix Cordelia M.J⁵

¹ Associate Professor, Department of Plastic and reconstructive Surgery, Tirunelveli Medical College, The Tamilnadu Dr, MGR University, Tamilnadu, India

² Senior Resident, Department of Plastic and reconstructive Surgery, Tirunelveli Medical College, The Tamilnadu Dr, MGR University, Tamilnadu, India

³ Assistant Professor, Department of Plastic and reconstructive Surgery, Tirunelveli Medical College, The Tamilnadu Dr, MGR University, Tamilnadu, India

⁴ Post Graduate, Tirunelveli Medical College, The Tamilnadu Dr, MGR University, Tamilnadu, India

⁵ Consultant Plastic Surgeon, KIMS Health, Nagercoil

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Corresponding Author:

Dr. Felix Cordelia M.J

Consultant Plastic Surgeon, KIMS Health, Nagercoil.

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ABSTRACT

Objective: To determine the prevalence and pattern of mid-facial fractures and the validity of Le Fort rules in the current scenario in patients who presented at a tertiary care institute.

Methodology: This study was carried out in the Department of Plastic and Reconstructive Surgery at Tirunelveli Medical College, India from January 2021 to December 2022. The study included 141 patients who had facial fractures. After confirming that the patient had a mid-facial fracture, they were categorized based on the mid-facial buttress involved. The data was collected and analyzed using SPSS statistical package version 23.

Results: A total of 141 cases were included as a part of this study, of which 129 were males and 12 were females. The most common etiology in this study was a road traffic accident (RTA) (91.47% in males and 91.66% in females), followed by assault in males (5.42%) and accidental fall in females (8.30%). The most common type of facial fracture in this study was a mid-facial fracture (74.46%). In mid-facial fractures, the most common region involved was the Zygomatico-Maxillary Buttress (56.19% in right mid-face and 55.23% in left mid-face). Classical Le Fort fractures accounted only for 7.61% of mid-facial fractures in this study.

Conclusion: This study is likely to point out a need for a different system to classify mid-facial fractures based on buttresses in addition to the traditional Le Fort classification. The classification should take into account

1. Which maxilla is fractured-Right, Left, or Both
2. Fractures of the various buttress
3. severity of the buttresses

Thus our study serves to trigger the need to re-classify mid-facial fractures based on the buttresses involved, gleaned from the changing trends of midfacial fractures.

Keywords: Mid-facial Fractures, Buttress, Le Fort Fracture, Etiology.

INTRODUCTION

It has been more than a century since Rene Le Fort proposed his classification of mid-facial fractures based on experiments conducted on 35 skulls(1), (2). With the worldwide escalation in the number of heavy and high-speed vehicles and the surge in the number of road traffic accidents, it is highly necessary to follow evenness in the diagnosis, classification, and management of traumatic fractures of the face. The low-speed impact fracture patterns inflicted on a cadaveric skull can no longer hold well with the current high-impact injuries encountered by clinicians.

Facial fracture patterns have to be defined based on a single entity that can be representative of all the fracture configurations and can be reproduced for easy communication by treating physicians. Early and accurate diagnosis of facial fractures could be made with the development of thin slices in computed tomography (CT), and the three-dimensional CT reformations(3). Customized surgical management of the fractures can be precisely planned based on the CT images(4). Mandible fractures have a clearly defined universal system of classification based on which fracture stabilization can be planned by any treating surgeon. However, no such comprehensive yet simple classification system of mid-face fractures exists until now. The recent midface fracture classification systems have their pitfalls and difficulties in understanding and remembering. The ultimate aim of fracture management is that the pre-traumatic form and function of the facial bones have to be restored in addition to the acceptable dental occlusion.

The prevailing mid-face fracture fixation methods focus mainly on the buttress supports of the face in addition to the anatomic repositioning of fracture fragments. Accordingly, the classification of mid-face fractures could be simplified based on the buttresses fractured unilaterally or bilaterally. The component of comminution or displacement could be indicated along with the buttresses involved.

MATERIALS & METHODS

The midface horizontal and vertical buttresses were the basis of our Tirunelveli Medical College (TMC) classification system of midface fractures. The Superior orbital rim (S), the Inferior orbital rim (I), and the Alveolar process(A) were the horizontal buttresses of the midface. The vertical buttresses were Nasomaxillary buttress (N), Zygomaticomaxillary buttress (Z), Frontozygomatic buttress (F) and the Pterygomaxillary buttress (P).

The presence of more than one fracture line in a particular buttress was given a tag of Comminution (c) and Displacement (d) or Bone loss (l) if any were also indicated. The classification not only simplified the understanding of fracture patterns but also defined the buttresses that required stabilisation to restore the premorbid condition. The nasal bone fractures and Naso Orbito Ethmoid fractures were not included in our TMC classification system as they were classified separately.

After institutional review board approval, we did a retrospective evaluation of our classification system by analyzing the medical records of patients with facial fractures, admitted and treated at the Department of Plastic Surgery at Tirunelveli Medical College. The records of patients admitted from January 2021 to December 2022 were included for evaluation. We excluded patients aged <10 years, whose clinical records were incomplete or whose CT imaging was unavailable. After exclusion, 141 patients were found to be eligible and their medical records were included for the study. All the patients had undergone open reduction and internal fixation of the facial fractures with or without Maxillo Mandibular Fixation(MMF).

The demographics of the patients were recorded along with details on mode and time of injury, and clinical symptoms. The three-dimensional CT scan of the face with axial and coronal images taken at the time of admission were assessed.

The radiological diagnosis of the patients with midface fractures was recorded using the proposed TMC classification system. The outcomes of the implementation of our new classification scheme were analyzed based on the comparability of the buttresses classified as injured and those that were fixed during surgery as per the records. The deviation of fracture patterns from the widely followed Le Fort classification were recorded and studied using SPSS software.

RESULT

The data unequivocally supports the study's title, "Changing Trends in Mid-Facial Fractures."

Finding		Data Point	Significance in Favour of Study
Gender Ratio	97 males vs. 8 females (mid-face fractures); 129 males vs. 12 females (total facial fractures).	The male preponderance (92.38% of mid-face cases) reflects a higher exposure to high-risk activities, particularly RTA.	
Dominant Etiology	91.42% of mid-facial fractures caused by Road Traffic Accidents (RTA) .	This validates the core premise: modern high-speed/high-energy trauma (RTA) creates fracture patterns (complex/comminuted) that differ fundamentally from the low-velocity impacts used in Le Fort's cadaveric studies.	
Le Fort Inaccuracy	Classical Le Fort fractures only account for 7.61% of cases.	This is the strongest evidence: the classic system is obsolete for diagnosing and planning treatment for the vast majority of current mid-facial injuries.	
Complexity/Comminution	93.33% of mid-facial fractures were associated with other fractures (mandible, frontal, orbit, etc.).	This demonstrates the high-energy nature of the injuries, resulting in complex, multi-site fractures (pan-facial trauma) that a simple linear classification cannot capture.	

Finding	Data Point	Significance in Favour of Study
Prevalence of Zygomatico-Maxillary Buttress (ZMB) Involvement	ZMB was the most common single buttress fractured on both the right (56.19%) and left (55.23%) sides.	This highlights the ZMB as the primary point of failure in modern impacts, a crucial piece of information easily identified by the TMC buttress system and often missed when solely looking for classical Le Fort lines.
Comminution Rate	Buttress fractures were comminuted in approximately 18.5% of cases (Right: 18.55%, Left: 18.94%).	The inclusion of the "Pattern" tag (c for comminuted, I for bone loss) in the TMC classification is justified by this data, as nearly one-fifth of buttress injuries involve complexity requiring specific surgical planning.

Buttress Involvement and Pattern Complexity for Validating TMC

The data strongly supports classifying mid-face trauma by individual buttresses, as fracture lines rarely adhere to a single Le Fort plane:

Buttress	Right Side Prevalence	Left Side Prevalence	Key Finding
Zygomatico-Maxillary Buttress (ZMB)	56.19%	55.23%	Most Commonly Fractured. ZMB is the main vertical buttress supporting the cheek and maxilla; its consistent involvement dictates the need for mandatory surgical fixation in over half the cases.
Infra-Orbital Buttress (IOB)	40.95%	49.52%	High Horizontal Buttress Involvement. The IOB forms the inferior orbital rim. Its frequent fracture, especially on the left, highlights the high rate of orbital floor and rim injuries that accompany mid-face trauma, requiring specific orbital reconstruction planning.
Comminution Rate	Right: 18.55%	Left: 18.94%	Nearly one-fifth of buttress injuries involve comminution , justifying the inclusion of the 'c' (comminuted) tag in the TMC classification to guide hardware choice and reduction strategy.
Multi-Buttress Injuries	Crucial Finding: The vast majority of injuries are not simple. Only 22.85% of right-side fractures and 77.15% of left-side fractures involved a single buttress (1B). This overwhelming complexity proves that a simple, single-plane classification is inadequate and requires the multi-faceted detail provided by the TMC system.		

DISCUSSION

Le Fort classification

Fracture Type	Description	Key Features & Location
Le Fort I (Horizontal)	A transverse fracture separating the hard palate and the upper dentition (the tooth-bearing part of the maxilla) from the rest of the facial skeleton.	The fracture line runs horizontally above the roots of the teeth, across the lower nasal septum, and through the walls of the maxillary sinuses and the pterygoid plates. This results in a "floating palate."
Le Fort II (Pyramidal)	A pyramidal fracture pattern detaching the maxilla and nasal bones from the skull base.	The fracture line extends superiorly through the nasal bones and the medial aspect of the orbits (including the lacrimal bones and orbital floor),

Fracture Type	Description	Key Features & Location
		then posteriorly through the inferior orbital rims and the pterygoid plates. This results in a "floating maxilla" with the nose.
Le Fort III (Craniofacial Disjunction Transverse)	The most severe type, completely detaching the entire midfacial skeleton from the cranial base.	The fracture line runs transversely across the nasofrontal suture, through the orbital walls (medial and lateral), and through the zygomatic arches and the pterygoid plates. This results in a "floating face."

1901, Lefort categorized the fractures into three but it was oversimplified and insufficient for surgical planning. So in order to fill the lacuna numerous classifications came into existence.

Wassmund Classification of Midface Fractures

1927, Wassmund classified the fractures into 3 types with 4 grades with additional categorized types A,B,C . It can be flawed due to its reliance on a specific, often idealized fracture line.

This classification is one of the older systems for maxillary fractures and has a strong correlation with the more commonly used **Le Fort classification**.

Wassmund Type I (Similar to Le Fort I):

Description: A **horizontal fracture** separating the lower part of the maxilla, including the hard palate and the tooth-bearing segment (dentoalveolar segment), from the rest of the facial skeleton.

Fracture Line Location: Runs above the apices of the maxillary teeth, through the lateral and medial walls of the maxillary sinus, and the pterygoid plates.

Mobility: The entire palate and upper dental arch move as a single unit, independent of the rest of the face.

Wassmund Type II (Similar to Le Fort II):

Description: A **pyramidal fracture** involving the central midface.

Fracture Line Location: Extends superiorly to include the nasal bones, medial walls of the orbits, and the inferior orbital rim, continuing posteriorly through the maxilla and pterygoid plates.

Mobility: The maxilla, nasal bones, and a portion of the orbital floor move together.

Wassmund Type III (Le Fort III without Nasal Bones):

Description: A high-level transverse fracture separating the midface from the cranial base, but specifically **excluding** the nasal bones (or the naso-orbito-ethmoid complex).

Mobility: The midface is essentially detached, but the fracture pattern is considered less complex cranially than a full Le Fort III.

Wassmund Type IV (Similar to Le Fort III):

Description: A **craniofacial disjunction** (separation of the entire midfacial skeleton from the skull base).

Fracture Line Location: Extends through the nasofrontal suture, the fronto-maxillary sutures, the entire orbital walls, and the zygomatic arches/zygomaticofrontal sutures, and the pterygoid plates.

Mobility: The entire midface, including the zygomas (cheekbones) and nose, is mobile relative to the cranium.

Rowe and Williams Classification of Midface Fractures (Maxillary)

1985, Row and William categorized on fracture and change in occlusion but cranial base and extensive comminuted fractures were not classified as Le Ford system, and this system doesn't fully capture the intricacies of all midfacial fracture configurations.

Fractures Not Involving Occlusion: These fractures do not significantly affect the relationship between the upper and lower teeth. They include:

Fractures of the **central region** (e.g., nose, nasal septum, nasoethmoidal complex).

Fractures of the **lateral region** (e.g., zygomatic complex/cheekbone).

Fractures Involving Occlusion: These fractures displace the tooth-bearing parts of the maxilla, resulting in a change in the bite. They are often categorized similarly to the Le Fort classification:

Dentoalveolar (fractures involving only the teeth sockets and alveolar bone).

Subzygomatic (corresponding to Le Fort I and Le Fort II fractures).

Suprazygomatic (corresponding to Le Fort III fractures, or craniofacial disjunction).

Marciani's Modification of the Le Fort Classification

1993, Marciani's classified these fractures into 4 types which focussed on characterizing fracture configurations, diagnosis, and surgical planning. But it was based on low-velocity trauma. Modern trauma, often involving high-velocity impacts, results in more complex and varied fracture patterns that don't always neatly fit into Le Fort categories

Marciani Level	Equivalent Classic Fracture	Description of Subtypes
Le Fort I	Low Maxillary Fracture	I a: Low maxillary fracture with multiple segments.
Le Fort II	Pyramidal Fracture	II a: Pyramidal and nasal fracture.
		II b: Pyramidal and Naso-Orbito-Ethmoid (NOE) fracture.
Le Fort III	Craniofacial Dysjunction	III a: Craniofacial dysjunction and nasal fracture.
		III b: Craniofacial dysjunction and Naso-Orbito-Ethmoid (NOE) fracture.
Le Fort IV	Extended Le Fort II or III with Cranial Base Fracture	IV a: Le Fort II or III with supraorbital rim fracture .
		IV b: Le Fort II or III with anterior cranial fossa and supraorbital rim fracture.
		IV c: Le Fort II or III with anterior cranial fossa and orbital wall fracture .

Donat classification

1998, Donat classified with CT imaging and involved the buttresses, but remembering due to the convoluted categorization leads to pitfall. The system's intricate details, including specifying fracture morphology and involvement of different facial structures, can make it time-consuming and prone to errors if not used mediculously

Descriptor	Description	
Laterality	R (Right), L (Left), or B (Bilateral)	
Support Sites	V (Vertical Buttress) and H (Horizontal Beam) are followed by a numerical subscript indicating the specific location.	
Severity	A suffix is added to denote the severity of the fracture at that specific site. F: Fragmented (comminuted fracture) D: Displaced A: Attenuated (or non-displaced/simple)	
Type	Name	Location
Vertical Buttresses (V)	V1: Nasomaxillary	Medial maxillary strut (near the nose/medial orbit)
	V2: Zygomaticomaxillary	Lateral maxillary strut (near the zygomatic buttress)
	V3: Zygomaticofrontal	Zygomaticofrontal suture/buttress
Horizontal Beams (H)	H1: Supraorbital	Frontal bar/Supraorbital rim
	H2: Infraorbital	Infraorbital rim
	H4: Transverse Maxillary	Palate/Alveolar Process

A complex fracture of the right midface that involves the entire maxilla might be coded as: R(V1F, V2F, H2D, H4D)

AOCMF Classification System

Location by Major Unit

The simplest level identifies the major anatomical unit involved. For midfacial injury, the code is **92**.

91 = Mandible

92 = Midface

93 = Skull Base

94 = Cranial Vault

Region	Fracture Type	Description/Components
Central Midface	Le Fort I, II, III analogs, Naso-Orbito-Ethmoid (NOE)	Divided into Upper, Intermediate, and Lower Central Midface (UCM, ICM, LCM) partitions, which define the Le Fort levels.
Lateral Midface	Zygomatic En Bloc (ZEB) , Zygomatic Arch	Involves the zygoma and its attachments.
Internal Orbit	Orbital Walls (roof, floor, medial, lateral)	Fractures isolated to the orbit.
Palate	Palatal fractures.	Fractures of the hard palate.

morphology of the fracture within each subregion using descriptors for:

Fragmentation (nonfragmented vs. fragmented)

Displacement (non-displaced vs. displaced)

Bone Loss (no bone loss vs. bone loss)

2002, Buitrago classification got some limitations that include over-complicating the system, and potentially missing less common fracture patterns.

2014, Audige doesn't encompass all midfacial fracture patterns, especially those involving complex comminution or fractures of the ethmoid bone or nasal cavity and oversimplify some fractures, leading to misinterpretation and potential complications.

2018, Dreizen classification for mid-facial fractures, which focuses on the naso-orbito-ethmoidal (NOE) complex, has drawbacks related to its complexity and the potential for misinterpretation.

In order to overcome such difficulties in classifying and decision making in management, we have classified based on **sides and buttresses involvement and pattern** of the fractures and in addition to modification of Donat classification to include pterygomaxillary buttress and bone loss.

Side	Buttress involved		Pattern
Right (R) / left (L)	Horizontal buttress (H)	IOB (I) SOB (S) AB (A)	Comminuted (c) Bone loss (l)
	Vertical buttress (v)	ZMB (Z) NMB (N) PMB (P) FZB (F)	

Analysis in Favour of the Study

The Imperative for a New Classification

Our study, "Changing Trends in Mid-Facial Fractures – A Fact to Accept," successfully establishes the need to move beyond the traditional Le Fort classification by analyzing modern, high-energy trauma patterns. The foundational argument rests on the significant deviation of current fracture patterns from the classic Le Fort rules.

Inadequacy of Traditional Classification (Le Fort)

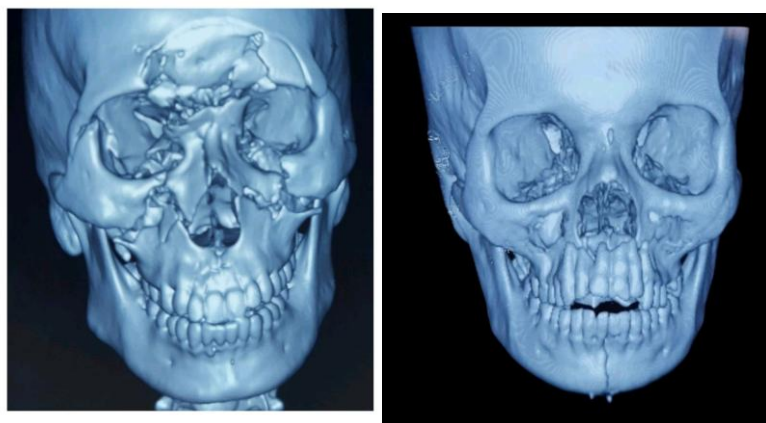
The most compelling data point supporting our objective is found in the **Associated Fractures** section: **Classical Le Fort fractures accounted for only 8 cases, or 7.61% of all mid-facial fractures** (Total=105). This fact alone provides the definitive rationale for proposing a new system. A classification system is only clinically valid if it accurately describes

the majority of cases; since the Le Fort system fails to account for over 92% of our mid-facial fractures, its utility for modern surgical planning is clearly limited.

Focus on Buttresses for Surgical Relevance

The discussion section rightly points out that the ultimate aim of fracture management is restoration of form and function, and current surgical methods **focus mainly on the buttress supports of the face**. By centering our **Tirunelveli Medical College (TMC) classification** on the horizontal and vertical buttresses (IOB, ZMB, NMB, etc.), you are creating a system that is inherently **more clinically relevant and actionable** than previous, anatomically-defined systems like Le Fort. The classification provides a direct "roadmap" for the surgeon: identify the fractured buttress, and that is the key structure requiring stabilization.

As per our **Tirunelveli Medical College (TMC) classification**, the following fractures (examples) classified as



Right ScIFNP, Left ScIZNP.

Right A, Left A

On adhering to our TMC classification gives detailed info regarding fractures and favours in rigid fixation of the buttresses.

TABLES AND FIGURES

Table 1 – Age Distribution and Etiology

AGE	MALE	RTA	FALL	ASSAULT	FEMALE	RTA	FALL	ASSAULT
11 TO 20	20	19	1	0	4	4	0	0
21 TO 30	49	45	2	2	4	4	0	0
31 TO 40	34	31	0	3	2	2	0	0
41 TO 50	14	14	0	0	2	1	1	0
51 TO 60	7	0	0	0	0	0	0	0
61 TO 70	2	0	0	0	0	0	0	0
70 TO 80	3	0	0	0	0	0	0	0
TOTAL	129	11	1	0	12	11	1	0
Percentage		91.66%	8.30%	0%		91.66%	8.30%	0%

Table.2 - ETIOLOGY-MIDFACIAL FRACTURE

ETIOLOGY-MIDFACIAL FRACTURE	MALE	FEMALE	TOTAL
RTA	(89) 91.70%	(7)87.50%	(96)91.42%
ASSAULT	(4)4.10%	0	(4)3.80%
FALL	(4)4.10%	(1)12.50%	(5)4.76%

Table.3 – PATTERN OF FRACTURES

FRACTURES	N0. OF CASES	%
MID-FACIAL WITH OTHER ASSOCIATED FRACTURES	98	93.33
ISOLATED MIDFACIAL FRACTURES	7	6.67
TOTAL MID-FACIAL FRACTURES	105	74.46
OTHER ISOLATED FRACTURES	36	25.53

Table.4 - RIGHT MID FACE – NUMBER OF buttresses INVOLVED		
RIGHT MID-FACE -BUTTRESS INVOLVEMENT	NO. OF CASES	%
1B	24	22.85%
2B	19	18.09%
3B	21	20.00%
4B	11	10.47%
5B	5	0.04%

Table.5 – LEFT MID FACE – NUMBER OF buttresses INVOLVED

LEFT MID-FACE-BUTTRESS INVOLVEMENT	NO.OF CASES	%
1B	24	22.85%
2B	18	17.14%
3B	22	20.95%
4B	10	9.52%
5B	5	0.04%

Table.6 – TYPES OF BUTTRESS FRACTURES

TYPES OF BUTTRESS FRACTURE	R-MAXILLA	L-MAXILLA
Simple	158(81.44%)	154(81.05%)
Communitied	36(18.55%)	36(18.94%)
	194	190

Table.7 –MID FACIAL BUTTRESS FRACTURE ON EACH SIDE

MID-FACIAL BUTTRESS FRACTURES	RIGHT SIDE	LEFT SIDE
IOB	43 (40.95%)	52(49.52%)
ZMB	59(56.19%)	58(55.23%)
NMB	35(33.33%)	39(37.14%)
PMB	35(33.33%)	29(27.61%)
AB	22(20.95%)	12(11.42)
SOB	9(8.57%)	10(9.52)
FZB	14(13.33%)	14(13.33%)

MAXILLA	HORIZONTAL BUTTRESS				VERTICAL BUTTRESS				
	1B	2B	3B	Displaced	1B	2B	3B	4B	Displaced
Right	55	3	1	10	22	26	18	14	7
Left	55	5	0	9	28	22	18	14	9

Table.8 – ASSOCIATED FRACTURES WITH MID-FACIAL FRACTURES

ASSOCIATED FRACTURES							
Orbit	Mandible	Zygoma	Palate	Nose	Frontal	NOE	LEFORT
18	56	24	7	10	5	9	8
17.14%	53.33%	22.85%	6.66%	9.52%	4.76%	8.57%	7.61%

CONCLUSION

Based on the robust data collected, our study successfully demonstrates the necessity and superiority of the proposed Buttress Classification for Mid-Facial Fractures (TMC classification) over the traditional Le Fort system.

The study's objectives were met by:

Determining the Etiology and Pattern: RTA is the overwhelming cause (91.42%), leading to complex, multi-buttress injuries.

Challenging the Validity of Le Fort Rules: The data confirms that only a negligible minority of cases (7.61%) conform to the classical Le Fort patterns.

The **TMC Buttress Classification** represents a crucial step forward in the standardized diagnosis and management of mid-facial trauma because it is:

Clinically Focused: It directly describes the structural components (buttresses) that require fixation to restore the facial skeleton, aligning classification with treatment protocol.

Comprehensive: By allowing for the clear designation of **side** (Right/Left), specific **buttresses involved** (Horizontal/Vertical), and **pattern** (Simple, Comminuted, Bone Loss), it accurately and fully describes the complex fracture patterns observed in 93.33% of our patient cohort.

Simple and Communicable: It offers a simplified yet comprehensive approach compared to previous, overly convoluted systems (Wassmund, Donat, etc.) highlighted in the discussion, thereby improving inter-surgeon communication and training.

Based on the analysis of 105 mid-facial fracture cases, our study definitively concludes that the **Changing Trends in Mid-Facial Trauma** have rendered the classical Le Fort classification clinically inadequate.

Le Fort Obsolescence: Only 7.61% of fractures conformed to Le Fort patterns, while 91.42% were caused by high-energy Road Traffic Accidents (RTA).

Clinical Necessity: The majority of injuries (93.33%) were complex, multi-site fractures, with over 77% involving two or more structural buttresses.

TMC Solution: The study successfully validates the need for a simplified, clinically-relevant **Tirunelveli Medical College (TMC) Buttress Classification** which describes the injury by **Side, specific Horizontal and Vertical Buttresses, and Pattern (Simple/Comminuted)**.

In brief, the study triggers the essential shift toward a buttress-based classification to ensure that diagnosis and surgical planning accurately address the complex, high-energy fracture patterns prevalent in modern practice.

Declaration by Authors

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