The Classic Reprint

Experimental Study of Fractures of the Upper Jaw

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Editor's note. The reader will recognize here the first two of the 3 long papers that Prof Le Fort wrote on his monumental experiments on human cadavers to determine the lines of least resistance in fractures of the face. I thought it fitting to have Dr Paul Tessier do this translation and commentary, but asked him to condense it to 10 pages. When we received his translation, the work was of such great interest that I decided to add to Tessier's condensation some of the descriptions of the actual experiments, and a few additional bits of text. These were translated by Kitty Dabney and Mary McDowell. Next month we shall publish a condensation of the third article by Le Fort, together with a commentary on the series by Dr Tessier.

Surgically speaking, we must consider as belonging to the upper jaw and face the pterygoid processes of the sphenoid bone and the lateral masses and lamina perpendicularis of the ethmoid - in a word, the whole bony mass hanging from the cranial base and immediately continuous with it.

In most previous works, the authors have studied the fractures of various bones of the face separately ... But the various parts that make up the upper jaw are united by sutures which do not prevent the propagation of fracture lines; consequently, they cannot be used as a basis for division of the subject. One would not dream of studying separately the fractures of the diverse bones of the skull; in the same way, it is impossible to separate the fractures of the upper jaw from those of the palatine bones, cheek, bones, etc.

It is not the same with partial fractures, however, limited to a circumscribed area - as, for example, fractures of the true nasal bones... All of the limited lesions are produced by a brusque blow on a small surface which alone yields to the wounding force.

I am eliminating one category of fractures from this study - gunshot wounds. Often the result of suicide attempts, these are veritable explosions in the face and are without surgical interest...

Wounds made by sharp instruments, such as those from saber cuts ... must also be excluded from this study. And finally we exclude certain fractures of the face which are only a concomitant of a fracture of the base of the skull. Often there is misunderstanding on this subject.
Frequently after marked trauma there is a simultaneous serious fracture of the skull and a fracture of the face. The fact is incontestable; the interpretation is not ... In the vast majority of cases, the facial fracture is not dependent on the skull lesion and does not necessarily accompany it; skull fractures due to force exerted exclusively on the skull do not spread to the face other than in an exceptional and always insignificant manner... The possibility of inflicting a skull fracture from a facial fracture is most interesting; we shall return to it.

I have studied fractures of the upper jaw with their concomitant vast and notable contusions and compressions. I will use the term *indirect* fractures (if that term hasn't been used too frequently for fractures of the superior maxilla) to designate those fractures caused by force at the level of the neighboring bones... There is a regrettable confusion in terminology; a fracture is *direct* when it is produced at the point of contact with the blow - *indirect* when it is produced at a distance from the blow, even if it is on the bone itself...

The laws that govern fractures are the general laws of body resistance, and the laws of action and reaction. Action is represented by the site of the application and the extent of the applied area of the force - the direction of this force, its velocity, its duration, and the mass of the wounding agent. Reaction is everything that opposes the simple displacement of the body subjected to the impact - in other words, the degree and the means of fixation of the body undergoing the strain. The effect of these two forces depends upon the architecture and the texture of the bones. For any variation in one of these causes, there may be a corresponding variation in the effects; herein lie the reasons for their infinite clinical variety, and for the torments of experimenters...

The rapidity of the wounding agent, and the extent of the surface which it disturbs, influence the results; the greater the rapidity of the blow or the smaller the surface, the more the tendency to local lesions; but when a local lesion is produced, the effort is expended in this and the ulterior action simulates a slower blow if the force is sufficient to cause new damage. Here the duration of action intervenes.

The mass of the wounding agent does not play a role, except relative to the degree of the lesions produced.

There remain, then, 3 important conditions which must guide the experimenter. The first two depend on the action; they are the point of application of the force, and the direction of the wounding agent. The third stems from the reaction; it is the degree and the position of the head during the trauma...

An eminently favorable condition for the experimental study of fractures of the bones of the face is the almost non-existent role of muscular contractions in the production of these fractures... Of the muscles of the face, only the pterygoids have any real influence on the displacement of the fragments. These very advantageous conditions permit us to draw precise conclusions from our experiments, which can be applied clinically with certitude.

Nearly all the experiments were performed on whole cadavers, or after decapitation. In almost all cases, after having exerted a force directly on the face (or at a distance from it)
I sawed the skull circularly, detached the *dura mater*, and examined the cranial bases for possible traces of a fracture. Then the head was boiled to enable me to remove the soft tissues easily.

The cleaning of a fresh head, before boiling or macerating it, is almost impossible without creating some fractures. The osseous planes are slender and yield to the least effort...

Before going into detail on my experiments, I'd like to point out certain things which struck me peculiarly. First is the *intensity of the violence* necessary to produce a fracture of the face. The bony mass which constitutes the upper jaw has particular characteristics which one does not encounter at any other point in the body. It is formed by some columns of tissue, more or less spongy, between which are the very slender blades of compact tissue hung like curtains. The examination of a facial skeleton cannot give us an idea of the resistance of this mass. The bones (prepared and blanched) yield very easily to the least effort. Take a prepared skeleton and with your finger punch at the level of the canine fossa, for example, and you can go right through it without any difficulty.

On the contrary, when one takes a fresh and entire head and inflicts various traumas on it and dissects it, he will find it has resisted. Why? Because the fragile parts are not easily accessible to direct trauma, and because the projecting parts are resistant. The fragile parts are covered on all sides by soft tissues, which considerably augment the solidity by lending their elasticity to spread and dissipate the forces of trauma...

The face resists these forces because of the elasticity of its bones, periosteum, and soft tissues. The extreme thinness of many of its parts does not decrease its resistance, but exaggerates its elasticity. When the limit of elasticity is finally exceeded, it breaks - but the fractures therein differ from those of the long bones. They are usually long fissures, without damage to the soft tissues; displacements of the fragments are exceptional.

And still these displacements are mentioned in almost all observations. The following will explain it.

Until 1866, when A. Guerin showed the possibility of diagnosing certain fractures of the upper jaw that were not displaced, one did not recognize the resulting hollows in the face, and gross lesions passed unnoticed. Experimental study demonstrated that almost always, following trauma to the face of sufficient strength to produce widespread bony lesions, the bones remained in their normal positions and nothing would lead one to suppose, at first glance, that there was a fracture... *The fracture without displacement is the rule.* One can say of this phenomenon the same thing the surgeons say of a double transverse fracture: "If it is easy to produce on a cadaver, it is impossible that it does not appear frequently in the living patient."

This absence of displacement together with the extremely rapid healing, proved by clinical observations, indicates that *fractures of the upper jaw are the most frequently unrecognized* and, for that reason, are considered to be rare...

This absence of displacement and of lesions of the soft parts often makes it very difficult to diagnose these fractures. One can say that on a cadaver it is never possible to do
it completely. Serious and widespread lesions generally do not manifest themselves by any exterior sign. Often, educated doctors who helped me with my experiments advised me, after the first blow, to hit again - convinced that there was no lesion when actually the damage was most extensive...

It would appear that the diagnosis could be singularly facilitated if the surgeon, when confronted by a facial contusion, knew which were the weak points, the lines of least resistance - where, at last, he must look to awaken the pain which often will be the only revealing symptom. This was the practical goal of the present work...

**Anteroposterior Blows On The Upper Lip**

A. Guerin, whose name remains attached to this variety of fracture, wrote: "When a violent blow is struck backward on the face, as if one wanted to push in the part of the upper jaw lying below the nostrils, a transverse fracture is produced which passes about one cm below the malar bone and extends through the pterygoid processes; the latter processes are always fractured at the level of the lower end of the pterygomaxillary fissure - ie, where they have the least resistance"...

On the initiative of Guerin, Cocteau undertook at Glamart 7 experiments; these supported the convictions of the master. The experiments were repeated later on many occasions. M. Lejeune reproduced them on 5 cadavers, and 5 times he obtained the transverse fracture; M. Fillion did them 3 times and M. Papin many times, always with the same results...

The authors who first described these fractures did not place any importance on concomitant lesions, such as the palatine split. Lejeune, who noted the lesion in his first two experiments, did not report it in the next 3 experiments...

I did some experiments on this fracture. A considerable force was necessary to produce it. Three times (Experiments I, II, and III) I obtained only insignificant crushing of the front wall of some tooth sockets. In two other experiments (IV and V) the first blow produced a partial transverse fracture simultaneously with a complete palatine fissure running from front to back. The second blow completed the transverse fracture in Experiment IV, but in Experiment V it completed it only on one side...

**Experiment I**

Female, approximately 50 years old. Entire cadaver, supine, face turned up. Three blows with a club were applied directly to the front of the upper maxilla, with moderate force. At examination, only insignificant lesions of the alveolar border were found.

**Experiment II**

Male, approximately 65 years old. Entire cadaver, lying on the ground supine, with face up. One blow with the heel applied forcefully on the upper lip was accompanied by a bony cracking. Dissection revealed only a minimal crushing of the front wall of the alveolus (recently deprived of teeth).
**Experiment III**

Male, about 45 years old. Decapitated specimen. The head was hurled against the round edge of a table, so as to apply force to the upper lip. The result was negative.

**Experiment IV**

Male, about 65 years old. After decapitation, the head was thrown violently against the rounded edge of a marble table. The first blow did not seem to produce a fracture. After a second blow, one noted a fissure between the nasal orifice and the canine fossa ... the palatine vault was fractured between the two incisors and the fissure extended backward to the right and near the midline to the apophysis of the palate. The pterygoid processes were broken, the left at the level of the lower portion of the pterygomaxillary fissure... A third blow, administered like the first two, was necessary to achieve a horizontal fracture. It was very high, near the cheek bones, but did not cut them open.

**Experiment V**

Macerated head, covered only with some soft parts. Supported in a hollow, on the occiput, face looking up. The first blow was directed at the upper edge of the alveolus, from the front backward. The force, administered with a club, hit below the left incisors. A fissure was produced from the front to back of the entire palatine vault. Another fissure divided the lower portion of the nose on the right side and traversed the lower part of the cheek bone, but the fracture in the cheek bone was incomplete.

A second blow lengthened the fissure, and the right pterygoid process was broken. On the left side, the malar was dislocated at the level of the frontal and the zygomatic process; the whole left maxilla, including its processes, formed a great fragment with the malar on the same side and the palate...

**Lateral Blows On The Lower Part Of The Upper Jaw**

M. Fillion, in 4 experiments, obtained in the first two a fracture on only the maxilla which was hit... M. Papin repeated these experiments and he distinguished the results of blows over the canine from those delivered over the molars... With horizontal blows delivered at the level of the canine tooth, he once obtained a large horizontal fracture...

I did two experiments on this subject. It was difficult to wound the superior maxilla laterally without wounding the malar bone or the mandible at the same time - and it is probably rare that one encounters lesions produced by this mechanism.

**Experiment VI**

Male, about 45 years old. Cut off head, partly depilated of its soft parts. It was placed, right side down, on a table. Several blows with a wooden club were directed at the left side of the face, at the left part of the alveolar arch, and below it. The angle of the mandible gave way on the right side, which rested on the table.
At dissection, there was a transverse fracture of the upper jaw, separating the nasal cavity and running back toward the pterygoid processes, where it stopped... The right zygomatic arch was broken, disjointed in front from the malar...

A new blow, directed like the preceding ones, fractured the pterygoid processes at their bases and parted the ethmoid and vomer. Guerin's fracture was thus complete.

Experiment VII

Man, about 50 years old. Entire cadaver supine with the head hanging backward over the edge of the table. A violent blow was struck with the club on the right upper jaw, beneath the malar. The force was directed obliquely from bottom to top, as though the subject were standing... When the specimen was dissected there was a transverse fracture of the maxilla on the right, cutting all of the bones as in Guerin's fracture. On the left, a fissure divided the nasal cavity fairly low, then ascended to reach the suture at the lower edge of the orbit, and then traveled obliquely to the sphenomaxillary fissure.

(From these) one obtains, a large transverse fracture in which one or both pterygoid processes sometimes remain intact; at times, there is an associated fissure of the palate.

After oblique lateral blows downward, one may see a fracture of the alveolus (if the force is exerted at a short distance from the teeth), or a separation of the whole lower part of the upper jaw (if the force is exerted higher).

After a lateral blow going obliquely upward, the fracture may be an ascending one. The horizontal fracture on the side receiving the blow may be continuous with an ascending fracture passing above the opposite malar bone. In a word, the fracture follows the direction of the force.

Blows Directed Upward On The Upper Alveolus

I did 3 experiments on this, and the results obtained were very comparable to each other...

Experiment VIII

Old person, almost edentulous. The cadaver was supine, with the head protruding over the table and hanging back. The mouth was wide open. A moderate blow with a wooden club fell level on the upper dental arch - that is to say, from bottom to top and from front to back (as though the subject were standing). The force was minimal; the assistants were sure that there was no lesion.

Dissection after boiling. A large fissure skirted the malar bone; from the sphenomaxillary fossa, it traversed the orbital floor, skirted the pyramidal process while passing the canine fossa, then below the edge of the alveolus to ascend again in the back toward the posterior edge of the maxilla. About 12 mm from the edge of the orbit, a branch ran from the main fissure to reach the inferior part of the nasal cavity...
**Experiment IX**

Man, about 45 years old. The cadaver was positioned in the same manner as in the preceding experiment, and the blow was delivered in the same way, but violently. There was a clear feeling of bony cracking. All of the palatine arch was movable and was forced back.

At dissection, two fracture lines, ascended vertically to the middle of each nasal bone, then inclined outward symmetrically to traverse the ascending processes of the maxillae, reached the nasolacrimal duct on each side, passed along the floor of the orbit to exit at the suture between the malar and maxilla. From this point, the symmetry was no longer absolute...

After ablation of the fractured part, there remained adherent to the base of the skull the central and superior parts of the nasal bones, and the malar bones with the tops of their pyramidal processes - allowing a view of the most external part of the maxillary sinuses. All of the middle part of the face had disappeared.

In summary, there was a falling back of a large fragment which consisted of almost the entire two superior maxillae. This fragment was itself divided into secondary fragments.

**Experiment X**

Man, about 45 years old. The cadaver was positioned as in the two preceding experiments, and the blows were administered in the same fashion. The first blow (minimal) deviated to the left and did not produce a lesion; the second blow was more violent.

At dissection, on the right a fissure divided the orifices of the nasal fossae below the nasal bones, traversed the superior process and then went along a small part of the orbital floor, descending to the canine fossa and falling into a large transverse fracture. On the left, almost symmetrical lesions were present... As in the other experiments, the condition of the palatine mucosa did not cause one to suspect the lesion...

In Experiments IX and X, the lesions were more extensive. The fissure that goes around the malar bone was still to be found, but the lesion was double and the whole middle part of the face had yielded.

This particular lesion (which will be met again, produced by a different mechanism) displayed clear-cut characteristics. A large fissure started upward from the nasal notch, reached the orbit, and left it to pass symmetrically around the malar bones and cut the pterygoid processes adjacent to their bases. The nasal bones, more or less intact, remained partly adherent to the skull - as did the malar bones and a part of the malar processes of the maxillae. The remainder of the face, including the pterygoid processes, formed part of a large, circumscribed fragment. Furthermore, this fragment was divided by a fissure that crossed the whole hard palate from front to back. In addition, there was a large transverse fracture (Editorial note. Guerin, or Le Fort I, fracture.) on one side in Experiment IX; it was complete and double in Experiment X.
Blows Backward On The Midface

It appears that forces exerted on the midface produced results comparable to those following direct blows from below upward on the upper alveolus. It is helpful to compare Experiments IX and XI which report this. In the two cases, all the midface gave way - almost following the same lines. The facial fragment circumscribed by the large fissure had, in the two cases, suffered the same divisions - anteroposterior fracture of the palatine arch, and transverse fracture of the upper jaw...

I have tried, without success, to produce fractures of the upper jaw by precipitating a whole cadaver, face down, against a padded and resistant substance. Always, the cadaver has turned aside while falling, or the shock has been insufficient to produce the lesions...

Experiment XI

A woman, about 65 years old, the head, taken off, was placed firmly in a hollow on the occiput, the face looking up. A violent blow with a club was administered to the anterior part of the face, avoiding force on the cheek bones.

The lower end of the nasal bone was fractured on the left side. From there, the fracture line went up between the nasal bone and the ascending process of the maxilla, where it completely disjoined the suture. Then the line traversed the floor of the orbit at the level of the articulation with the malar, following the suture to the cheek tubercle. On this side (left) the separation of the malar and maxilla was complete and exactly at the level of the suture. All of the maxillary portion of the floor of the orbit remained adherent to the maxilla on this side.

On the right, the fracture line commenced at the external and superior part of the nasal incisure, traversed the ascending process, and followed the internal inferior angle of the orbit. Another line, coming out of the preceding one, cut the inferior wall of the orbit, then its anterior edge, and separated the malar from this side of the maxilla. A fragment of the zygomatic process adhered to the malar. The two pterygoid processes were broken at their bases. The nasal septum was fractured below and above. The two maxillar remained completely separated from the face.

The large fragment which comprised the midface was itself divided by a fracture of the hard palate. There was a disjunction in the midline from the alveolar border to the level of the palatine bone; at this level, the fissure traversed the palatine process on the right obliquely, in such a way that it abutted midway between the midline and the pterygoid process.

Finally, a horizontal fracture, situated high, divided the fragment of the right side into two portions - one comprising the palatine arch and alveolar border, the other the ascending process of the maxilla.
Experiment XII

Woman, about 50 years old. Supine, head placed on the occiput, face looking up. A blow with a club was applied directly to the top of the nose.

At dissection, the lesions were limited to the bones of the nose. The lower half of the nasal bone on the right, and the inner part of the left nasal bone, formed a small, free fragment, broken clean without splinters.

Experiment XIII

Very old woman, completely edentulous. The cadaver being supine on the ground with the face looking up, it was kicked violently on the lower part of the face, avoiding the cheekbones.

After dissection, only a broken right canine fossa was found...

Blows Downward On The Base Of The Nose

(Editorial note. The author did no experiments on this, but cites previous work by others.)

Upward Blows On The Mandible

... I have tried to evaluate the question and at first I tried to crush the maxilla between the skull and mandible. One case failed completely (Experiment XIV); the skull and the mandible gave way, while the upper jaw alone resisted. In another (Experiment XV) the cervical vertebrae gave way, the force having been misdirected... Attempts to precipitate the head on to the mandible (Experiment XVI) yielded only insignificant shock to the teeth...

The results of applying force to the chin were more successful. In Experiment XVII, in addition to a fracture of the mandible, there was a fissure which completely outlined the pyramidal process, so that the malar was held only by its superior and posterior angles. In Experiment XVIII, the canine fossa gave way while the alveolar arch resisted, in spite of its thinness. The mandible was dislocated...

(Editorial note. These experiments are then described in detail. Only part of the Experiment XVII will be reprinted here.)

Experiment XVII

Old woman, about 60. The cadaver was in the dorsal decubital position, the head lying beyond the edge of the table and hanging free. The mouth was open. A very violent blow was administered with a club to the chin. External examination revealed only a fracture of the lower jaw.
At dissection, the mandible was found to be broken a little to the right of the midline, and there was also a fracture at the junction of the ramus and the body. On the right, there was also a fracture of the condyle.

In the upper jaw, a fissure separated the maxilla from the left cheekbone at the level of the orbital border. From there the fissure descended to outline the pyramidal process, then backward and finally upward toward the base of the pterygoid process and up again to the pterygomaxillary fossa. In the orbit, the fracture followed the infraorbital canal for 1.5 cm, then stopped a short distance from the pterygomaxillary fissure in such a way that the cheekbone was hardly held, except by its superior and posterior angles...

It seems logical to consider together the lesions obtained by compression of the upper jaw between the mandible and skull - whether the upper jaw is immobilized against a resistant plane (supplied by the sternum or an external agent) or the force is exerted on the mandible (as in a fall on the chin or a blow up under the mandible)...

It matters little whether the mandible yields or not, but in all cases it is essential to distinguish between closed-mouth and open-mouth injuries. When the mouth is closed, the upper and lower teeth imbricate - adapting and corresponding to one another so that the face forms a whole, and the mechanism of fracture is that of bipolar compression (even when inertia fixes the skull). When the mouth is open, the lower jaw becomes the wounding agent by suddenly bringing together the dental arches... The lesions are comparable to those obtained by exerting direct force on the alveolar arch, with the mouth open.

This was actually demonstrated in our experiments. In Experiment XVII (blow on the chin) as well as in Experiment VIII (direct blow on the upper alveolus) identical lesions were produced, passing around the malar bone, despite the apparently different mechanisms...

**General Considerations Of Blows On The Malar Bone**

Blows to the malar bone must indubitably constitute the majority of facial injuries, due to the fact that the zygoma is the most exposed part. This has been confirmed by our observations, and by the studies of previous authors...

**Lateral Blows To The Malar, The Head Being Unsupported**

Following a force exerted laterally against the cheekbone, while the head is hanging free and not supported by a resistant plane, the dominant lesion is a breaking in of the cheekbone into the maxillary sinus by collapse of the pyramid. The breaking in is moderate, and most often the internal wall of the sinus remains intact...

**Experiment XIX**

Old woman. Cadaver supine. The head was off the table, hanging freely behind. A violent blow was applied laterally on the right malar by an aide, using a club.

At dissection, the inferior part of the cheekbone was found to be partially into the sinus. There was a collapse of the pyramidal process which had been reduced to splinters
(these were detached in preparing the skull and are absent in the figure)... A small line, quite visible on the drawing, departed from the splintered region of the pyramid and fell horizontally into the nasal cavity. On the specimen, this line was difficult to see, but it was the photograph which revealed it.

**Experiment XX**

Man, about 50. The cadaver was supine with the head off the table, hanging backward freely. A violent blow was applied laterally to the right cheekbone by an aide, using a club at a very acute angle.

At dissection, there was a comminuted fracture of the center of the malar bone. The zygomatic arch had given way in the middle part, following a vertical line... At the pyramidal process, the maxilla had a comminuted fracture and the cheekbone was pushed into the sinus... Above, there was a disjunction of the malar and frontal bone at the level of the external angular process.

After removing the fragments circumscribed by the fissures, one saw that the line crossed the floor of the orbit, of which the anterior half had been fractured. The fissure passed near the nasolacrimal duct, without reaching it, and outlined the base of the pyramidal process, passing one cm from the alveolar border...

**Experiment XXI**

Man, about 45. Cadaver in same position as previous one. An extremely violent blow was applied to the left cheekbone with a club. The soft parts resisted.

At dissection, all of the left side of the face was the site of an extremely comminuted fracture. The left malar was reduced to 3 or 4 fragments; a small splinter of the superior angle adhered to the external angular process.

All the splinters of the fractured region were circumscribed by a huge fissure... (which also) traversed the alveolar arch between the canine and the left incisor, crossing the palatine arch obliquely toward the right pterygoid process... The vomer was fractured vertically behind, and the perpendicular plate of the ethmoid, cut at the level of the skull in back, was cut obliquely from back to front and from front to bottom. The zygomatic process was broken a little behind its middle.

All the bony mass limited by the large fracture line was composed of small splinters, and there were no other lesions beyond this line. When the splinters were removed, there remained a hole capable of holding a mandarin orange.

**Experiment XXII**

Aged woman, edentulous. The cadaver was placed in the same position as in the 3 preceding experiments, and the aide directed the force in the same way, laterally, with a club against the cheekbone - but the blow was not so abrupt.
At dissection, we found only an insignificant bony fraying of the lower part of the malar bone.

**Blows On The Cheekbone, Produced By Moving The Head Rapidly To Hit A Resistant Object**

When the rapidly moving head hit a resistant body (the mechanism of fractures from a fall), the effects were intermediate to those obtained by blows on the swinging head and those which resulted from crushing the face between two opposing forces...

**Experiment XXIII**

Man, about 60. The head, taken off and held solidly in the hands, was violently projected toward the padded edge of the autopsy table in such a manner that the forehead did not suffer; the force was applied to the anterior part of the left cheekbone, and to the left side of the nose. After the first blow, external examination revealed nothing. After the second, we saw a fracture of the inferior orbital rim. After the third, a fracture of the nasal bones and perhaps of the ascending process of the maxilla was present.

At dissection, on opening the skull we noted the presence of a fissure of the cranial vault ... it was accompanied by a subdural effusion of blood... On the side of the face, the left cheekbone was pushed into the sinus. It was a little lower and inclined, in such a way that the inferior angle was lowered, drawing near the maxilla. The orbital rim was also lowered. Above, there was a disjunction of the external angular process; behind, there was a clean-cut vertical fracture of the middle part of the arch and a fracture of the posterior angle of the malar... The pyramidal process was outlined by a large fissure and adhered to the cheekbone, with which it formed a large fragment. When the fragment was removed, the sinus was wide open...

**Experiment XXIV**

Aged woman, edentulous. The head, stripped almost completely of its soft parts, was violently projected against the round edge of a table. The blow hit transversely on the left cheekbone; the edge of the table met the bone on an oblique line from top to bottom and from front to back. Almost all of the face exploded into 3 fragments, completely detached... The fracture line commenced at the left malar ... at the line of encounter between the bone and the table edge. From there it passed to the floor of the orbit and across the inner aspect to reach the suture between the ascending process and the frontal. It descended between the process and the left side of the nasal bone, cutting its inferior half and commencing to cut that of the right bone, then went straight down to the nasal incisure. The line started again from this orifice, cut the ascending process on the other side, reached the other orbit and traversed its medial wall from front to back, crossing its floor transversely to the sphenomaxillary fissure. From there, it went upward toward the external wall of the orbit, staying 2.5 cm posterior, toward the external angular process of the frontal bone - which it had separated from the superior angle of the malar.

*(Editorial note. Le Fort continues with another page of description of the various fractures in Experiment XXIV.)*  
*(To Be Continued)*