

THE ZIG-ZAG OSTEOTOMY

By

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In September 1952 a ten year old boy admitted under my care with a marked varus deformity of the lower part of the left tibia with shortening, particularly of the medial side of the bone. (Fig. 1). The aetiology was unknown.

An osteotomy was planned between the middle and lower thirds of the tibia, with the aim of correcting the angular deformity, allowing elongation, particularly on the medial side, and ensuring rapid sound union.

To attain these ends it was decided to make a zig-zag cut across the bone, (Fig. 2), so that when the angulation was corrected and elongation obtained the bony spikes would retain sufficient contact to ensure union. (Fig. 3). It was expected that the osteotomy would behave as a comminuted fracture, and that callus formation would be profuse.

Procedure.

The osteotomy was performed sub-periosteally with an electric saw, the cuts being completed with a fine osteotome. It was possible to cut the anterior cortex of the bone with considerable accuracy, but the zig-zag pattern was naturally less perfectly obtained on the deeper muscle-covered surfaces of the bone. This technical imperfection proved, however, to be unimportant. It was possible to correct the deformity completely, to elongate the bone without losing contact, and at the same time to maintain some stability of the fragments. Full correction, however, proved too great a strain on the soft tissues and it was therefore decided to complete the correction later by wedging the plaster cast. In the event callus formation was so speedy that this plan failed and only a partial correction was finally achieved. (Fig. 4).

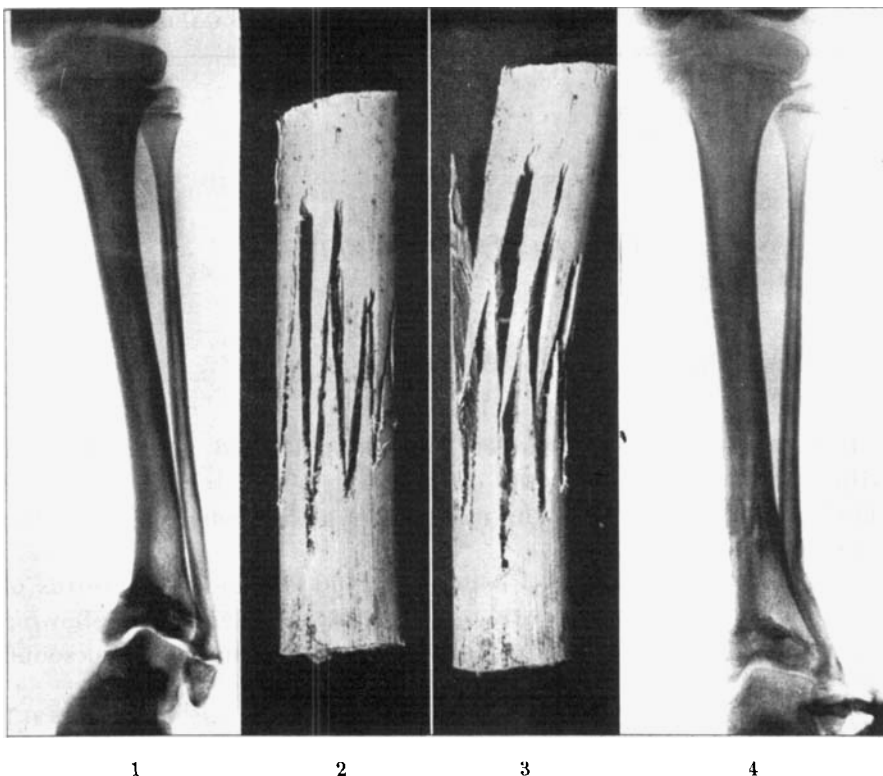


Fig. 1-4.

Fig. 1. Varus deformity of tibia with shortening, particularly of the medial side of the bone.

Fig. 2. Bamboo model showing zig-zag cuts.

Fig. 3. Bamboo model showing method of correction.

Fig. 4. The deformity partially corrected, with plenty of callus.

However, the simplicity of the procedure and its other obvious advantages, of good bony contact, good stability and excellent callus formation, encouraged us to use this type of osteotomy for other purposes. Thus, in addition to its use in the correction of angular deformities in one or more planes, the technique has been employed in the performance of rotation osteotomies and in the shortening and lengthening of bones.

Correction of angular deformities in one plane.

The method finds its simplest application when the cuts can be made in the plane in which correction is desired.

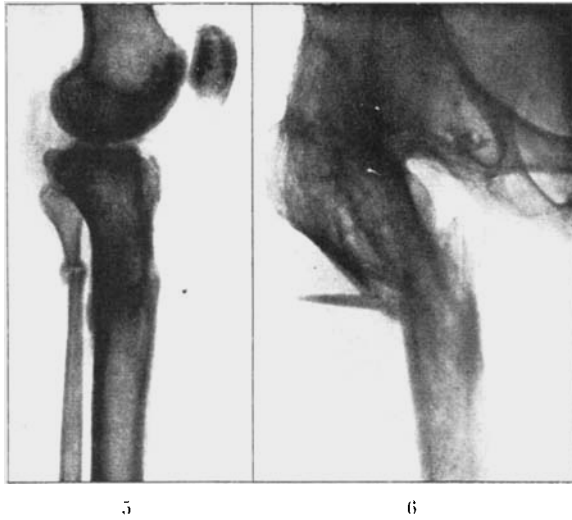


Fig. 5-6.

Fig. 5. Genu recurvatum after correction.

Fig. 6. Corrected adduction-flexion deformity of hips.

Fig. 5, demonstrates the correction of a genu recurvatum in a nineteen year old girl. She was discharged from hospital walking unaided six weeks after operation.

When the site of the osteotomy makes it difficult to place the cuts in the plane of the desired correction they may be placed at right angles to that plane. (V.S. Figs. 1-4). Thus, cuts in the sagittal plane are employed for a correction in the coronal plane.

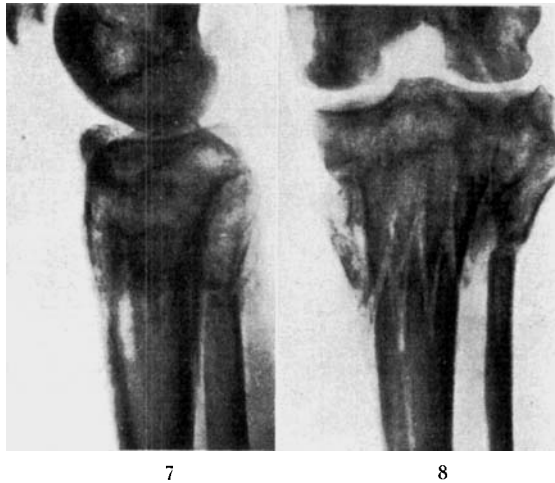
Correction of angular deformities in two planes.

An example of this problem was a thirty-two year old man whose right hip was ankylosed in 60° of flexion and 30° of adduction.

Antero-posterior cuts in the subtrochanteric region allowed correction of the flexion deformity and the adduction was simultaneously overcome by impacting the lateral bone spikes. (Fig. 6). Callus formation was rapid and full weight bearing without plaster was started six weeks after operation.

An twenty-nine year old man had recurvatum and varus deformities of the knee resulting from a severe fracture of the tibial condyles.

Antero-posterior cuts allowed correction of both deformities in a manner similar to the case described above. (Figs. 7 and 8).



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Fig. 7-8.

Recurvatum and varus deformities of knee corrected.

Plaster immobilization was discontinued three weeks after the operation, to start active movements of the knee.

Correction of complex deformities.

Fig. 9 is picture of the forearm of a nineteen year old boy. This complex deformity was the result of malunion in a fracture of the lower end of the radius.

Numerous zig-zag cuts were made, and the splintered bone was then bent and twisted into better alignment. (Fig. 10).

Rotation osteotomy.

The photographs of models in Fig. 11, 12, 13 demonstrate the method. The degree of rotation required is first marked on the bone, and the spikes are then cut. They must not be too long, as it is necessary to distract the bone ends and to angulate them to achieve rotation. When this has been attained the bone ends are impacted.

Bone shortening.

The cuts are made slightly longer than the planned shortening, and the bone ends are displaced sufficiently to allow the spikes to impact, thus producing the shortening. (Fig. 14).



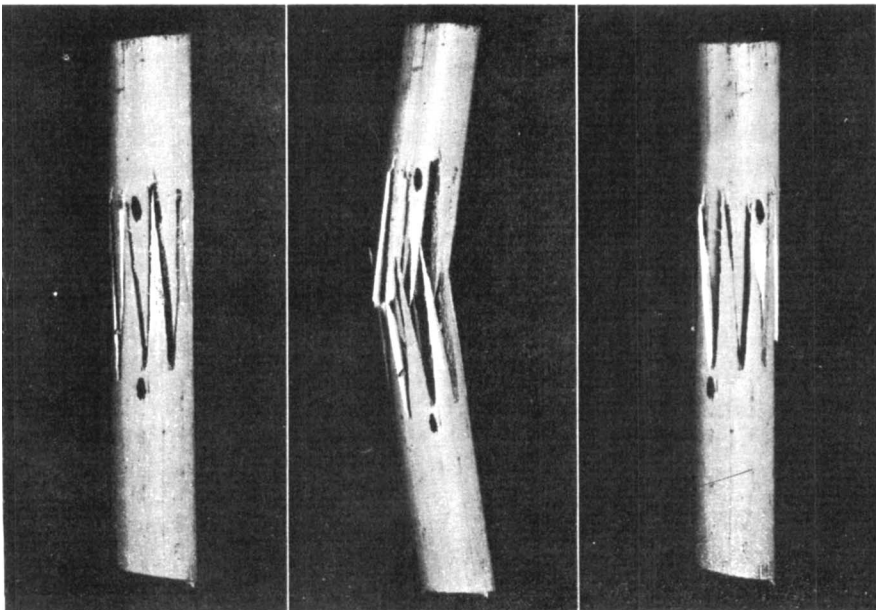
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Fig. 9-10.

Fig. 9. Complex deformity of radius, after malunited fracture.

Fig. 10. The same after correction.



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Fig. 11-13.

Bamboo models demonstrating the technique of rotation osteotomy.

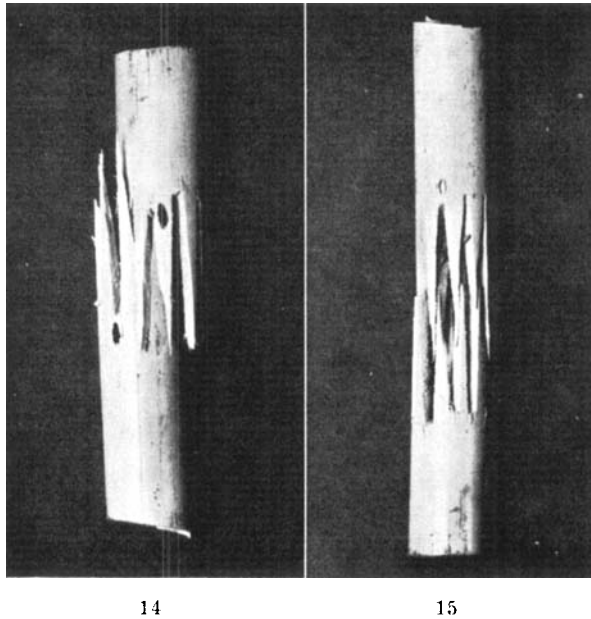


Fig. 14-15.

Fig. 14. Bamboo model demonstrating the technique of bone shortening.

Fig. 15. Bamboo model demonstrating the technique of sliding bone lengthening.

Bone lengthening.

Long cuts allow considerable elongation without loss of bony contact, and good stability can be maintained. (Fig. 15). If the desired increase in length can be achieved on the table the distracted position can be stabilized by additional "step" cuts. More often the tension in the soft tissue makes immediate lengthening impossible, and gradual distraction of the fragments is obtained postoperatively by the use of a turn-buckle. Apart from the mechanical increase a further "physiological" lengthening may follow in growing bones, analogous to that sometimes observed after fractures.

Fixation of the fragments.

Internal fixation with plates and screws has not often been employed and is indeed in some cases impracticable, as it precludes post-operative adjustments.

Osteotomies of the tibia can be adequately immobilized in plaster, and wedging of the cast can be employed for later correction of the angulation when required.

Frequently immobilization has been obtained by two pins which transfix the fragments, above and below the osteotomy, and whose protruding ends are connected by a turnbuckle. This arrangement allows slow and very exact adjustment of the angle of the osteotomy. This method is particularly suitable for osteotomies of the femur, and, used in conjunction with a short plaster hip spica, gives good immobilization and at the same time allows free movement at the knee joint. Three weeks after the operation the pins are removed. The plaster is discarded when there is clinical and radiological evidence of union, usually a month after the operation.

SUMMARY

The Zig-zag osteotomy is a technically simple procedure, useful in the correction of angular deformities, in the performance of rotation osteotomies and in the operations of lengthening and shortening of bones.

The procedure maintains good bony contact and stability without internal fixation, and thus makes possible postoperative adjustments by wedging of plasters or the use of a turnbuckle. Bony union is rapid, and adjustments are therefore best done during the first postoperative week.

The inherent stability of the osteotomy makes extensive plaster immobilization unnecessary, allowing movement of adjacent joints. The rapidity with which bony union occurs permits mobilization of all joints and significantly shortens the period of hospitalization.

RESUME

L'ostéotomie en zig-zag est un procédé simple d'un point de vue technique, utile pour la correction des déformités angulaires lorsqu'on procède à des ostéotomies de rotation et dans les opérations d'allongement ou de raccourcissement des os.

Ce procédé maintient un bon contact osseux et la stabilité sans fixation interne et rend ainsi possible un ajustement post-opératoire par la fixation dans le plâtre ou l'utilisation d'une tourniquet. La jonction osseuse est rapide et c'est pourquoi les ajustements doivent de préférence être pratiqués dans la semaine qui suit l'opération.

La stabilité inhérente à l'ostéotomie fait qu'il n'est pas nécessaire d'avoir recours à une longue immobilisation dans le plâtre et permet

le mouvement des articulations adjacentes. La rapidité avec laquelle apparaît la jonction osseuse permet la mobilisation de toutes les articulations et signifie par conséquent que la période de l'hospitalisation peut être diminuée.

ZUSAMMENFASSUNG

Die Zick-zack Osteotomie ist ein einfaches und nützliches Verfahren zur Korrektur von winkelligen Deformitäten, zur Ausführung der Drehosteotomie und zur Verlängerungs- und Verkürzungsoperation von Knochen.

Das Verfahren hält guten Knochenkontakt und Stabilität ohne innere Fixation aufrecht, und macht daher postoperative Korrekturen mittels der Anwendung von Keilen oder Schraubenzügen möglich. Die knöchernen Heilung geht rasch vor sich und Korrekturen sollten daher am besten während der ersten postoperativen Woche vorgenommen werden.

Die Stabilität der Osteotomie macht ausgedehnte Ruhigstellung im Gipsverband unnötig und gestattet daher Bewegung der benachbarten Gelenke. Die Geschwindigkeit mit welcher knöchernen Vereinigung vor sich geht, erlaubt Mobilisierung von allen Gelenken und verkürzt den Krankenhausaufenthalt bedeutend.