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Implants for surgery — Usage of the terms "valgus" and "varus" in orthopaedic surgery

Implants chirurgicaux — Usage des termes «valgus» et «varus» en chirurgie orthopédique

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Foreword

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The main task of ISO technical committees is to prepare International Standards. In exceptional circumstances a technical committee may propose the publication of a technical report of one of the following types:

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— type 2, when the subject is still under technical development requiring wider exposure;

— type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical reports are accepted for publication directly by ISO Council. Technical reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 9586 was prepared by Technical Committee ISO/TC 150, *Implants for surgery*. The reasons which led to the decision to publish this document in the form of a Technical Report Type 3 are explained in the Introduction.

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Implants for surgery — Usage of the terms "valgus" and "varus" in orthopaedic surgery

0 Introduction

This Type 3 Technical Report has been prepared in order to state the differences in usage of the terms 'valgus' and 'varus' so that anomalies of usage, especially in relation to the hip joint, may be clearly understood and confusion minimized.

The Terminology Working Group (WG 1) of Technical Committee 150 (Implants for Surgery) of the International Organization for Standardization (ISO) has for some years been discussing the terms 'valgus' and 'varus' in an attempt to reach agreed definitions. The terms have been in use for centuries but their meaning seems to have varied from time to time. The present usage has developed in a haphazard manner, such that consistent definition of the terms seems to be impossible.

A discussion paper (document ISO/TC 150/WG 1 N 59) was prepared by ISO/TC 150/WG 1 and circulated widely throughout the world for comment. The results of the study of the comments reveal that the terms are now so ingrained in day-to-day use that it is most unlikely that they can be abandoned or replaced by alternative terms.

This Technical Report has been prepared in order to point out the differences in usage of the terms 'valgus' and 'varus' in orthopaedic surgery.

1 Scope and field of application

This Technical Report gives the present usage of the terms 'valgus' and 'varus' in orthopaedic surgery, and describes anomalies of usage in order that they may be clearly understood and confusion minimized.

2 Present usage

The terms 'valgus' and 'varus' are used to characterize certain deformities of limbs in the coronal plane of the body. The deformities may be centred on a joint or within the length of a long bone. The terms are mostly used in relation to deformities occurring in the lower limbs, and the only common use in the upper limbs is in relation to the elbow joint following supra-condylar fractures of the humerus, or abnormalities of the lower humeral epiphysis.

The term 'valgus' equates to a movement of abduction, such that the limb distal to the point of deformity is angled away from the median plane of the body in the coronal plane. Conversely, the term 'varus' is used when the part of the limb distal to the deformity is angled towards the median plane and thus equates to the movement of adduction (figure 1). Thus 'genu valgum', meaning a 'valgus' deformity of the knee, results in the limb distal to the knee being angled away from the other limb. 'Tibia vara' indicates that there is a 'varus' deformity of the distal tibia in relation to the proximal tibia.

It should be noted that distal deformity, particularly in a lower limb, tends to be balanced by an opposite deformity in the proximal part of the limb, and perhaps the commonest example of this is where 'hallux valgus' is associated with a 'varus' deformity of the first metatarsal (figure 2). This concept is vital to the understanding of the reasons for the different usage of the terms 'valgus' and 'varus' in relation to the hip joint.

3 Anomalies of usage

There are four areas where the use of the terms is anomalous:

3.1 The foot

Normally the foot is considered to be in the horizontal plane of the body and thus, strictly speaking, deformities of the toes should not be characterized by the terms 'valgus' and 'varus'. However, traditional usage is such that it would be impossible to eradicate the terms in this context. 'Hallux valgus' is probably the most common use for the term 'valgus'.

It should be noted that in the instance of the big toe, 'hallux valgus' in fact equates to the movement of adduction of the big toe although it conforms with the definition given above of the toe being angled away from the median plane of the body. The reason for this anomaly is obvious - the terms adduction and abduction in the foot relate to the axis of the foot and not to the median plane of the body.

Also, the terms 'valgus' and 'varus' are used to qualify some deformities of the hind foot. The 'valgus' calcaneum relates to eversion of the sub-talar joints and 'varus' calcaneum to inversion, seen when the patient is standing. The deformity may just be postural but may also be caused by some deformity of the bone due to soft tissue imbalance during growth, as in club foot deformity.

3.2 The hip joint

It is in relation to the hip joint and the upper end of the femur that major differences of usage of the terms 'valgus' and 'varus' occur.

The anatomy of the upper end of the femur is rather complicated in that there is an angle between the neck and the shaft of the femur in the intercondylar region which is normally considered to be 130° (figure 3). However, in the anatomical position there is also anterior angulation of the neck in relation to the coronal plane. During X-ray examination of hip joints, the femora are lying in the normal anatomical position, so that the neck is anteverted in relation to the shaft. Thus the neck/shaft

angle is distorted when viewed in an ordinary antero-posterior X-ray picture and, if anteversion is greater than normal, the neck/shaft angle appears to be greater than 130°, whereas with little or no anteversion the neck/shaft angle approaches 130°, assuming that development of the head and the neck of the femur are normal.

It should also be remembered that the hip joint is composed not just of the head of the femur and the acetabulum but also includes most of the neck of the femur. Just as there is an angle between the shaft and the neck of the femur, there is also a 'normal' angle between the neck of the femur and the acetabulum. This fact is important to remember when the anomalies of use of the terms 'valgus' and 'varus' in relation to the hip joint are considered below.

Anomalies of growth occur in the head and neck of the femur, usually giving rise to a reduction in the neck/shaft angle. If the head and neck of the femur are then placed in normal relationship to the acetabulum, the result would be to carry the shaft of the femur into 'varus' and hence such an anomaly is commonly known as 'coxa vara'. Conversely, if the shaft of the femur is put into the normal anatomical position then it might be construed that the head and neck of the femur are 'valgus' in relation to the acetabulum, and thus this deformity is sometimes called 'coxa valga' (figure 3).

Fractures occurring in the intercondylar region frequently give rise to deformity of the neck/shaft angle. A decrease in neck/shaft angle should be called 'femora vara' but in fact in most countries this is commonly called 'post-traumatic coxa vara'. However, this might be called 'femora valga' or 'coxa valga' for the reasons stated above.

Thus, the conflict relates to whether the deformity in the region of the neck of the femur should be related to the leg otherwise lying in its normal position, or whether it should be related to the effect on the leg if the hip joint, namely the acetabulum and femoral head and neck, is placed in a normal relationship.

3.3 Osteotomy of the upper end of the femur

The use of the terms 'valgus' and 'varus' in relation to osteotomy of the upper end of the femur is as confused as it is with deformities of the head and neck of the femur. The confusion appears to relate to whether the osteotomy is named after the deformity that surgery is intended to produce, or after the deformity that the surgery is intended to correct. Logically, an osteotomy should be described by its effect upon the distal femur if the terms are to be used within the accepted definition. Thus, osteotomy of the upper shaft of the femur, which results in the reduction of the neck/shaft angle, should be called a 'varus' osteotomy and, vice versa, an osteotomy which apparently increases the neck/shaft angle should be called a 'valgus osteotomy' (figure 4). Unfortunately, precisely the opposite interpretation is placed upon osteotomies in which the reduction of the neck/shaft angle is considered to cause a 'valgus' hip.

3.4 Femoral prostheses

'Valgus' and 'varus' are being used in relation to the insertion of prostheses to replace the femoral head.

With surface replacement of the femoral head, the replacement may be said to be 'valgus' or 'varus', depending on its relationship to the angle of the neck of the femur. Thus 'valgus' replacement of the femoral head cup usually relates to the cup being placed more superiorly than the anatomical orientation of the head would suggest. (figure 5). Conversely, if the cup is placed inferiorly, then 'varus' siting is produced (figure 5). The reasoning is that the neck/shaft angle of the femur should be measured from the centre of the prosthesis to the centre of the base of the neck, rather than from a line passing up through the centre of the neck of the femur.

When considering stemmed femoral prostheses, confusion arises because surgeons consider the relationship of the stem of the prosthesis to the shaft of the femur but not the deformity that the placing of the stem causes. Thus, if the tip of the stem touches the lateral cortex, this may be considered by some to be 'valgus' in relation to the stem, but it causes a 'varus' deformity of the shaft of the femur in relation to the head and thus should be termed a 'varus' deformity (figure 6). Similarly, if the tip of the shaft of the prosthesis touches the medial cortex of the femoral shaft, it causes a 'valgus' deformity of the shaft of the femur in relation to the neck and thus the placement of the prosthesis should be termed 'valgus' (figure 6). Once again, this placement of the prosthesis is sometimes termed 'varus' in that the stem is in a 'varus' position in relation to the shaft of the femur.

4 Discussion and conclusions

As a result of the comments received after circulation of the discussion paper prepared by ISO/TC 150/WG 1, it is quite obvious that the terms 'valgus' and 'varus' are unlikely to disappear. Unfortunately the terms have been used in a somewhat haphazard fashion, their usage having developed over the years without formal definition.

The definitions noted in clause 2 of this Technical Report cover most of the common and traditional uses of the terms. The anomaly of usage with respect to the foot has been pointed out but it must be accepted that such usage is so traditional that it is unlikely that this anomaly is of any significance.

However there appears to be a fundamental difference of usage of the terms in relation to the hip joint and upper end of the femur. The alternatives have been explained and illustrated in this Technical Report. The differences of usage over recent years have been used to describe deformities produced deliberately by osteotomies of the upper femur and also to describe placement of femoral head prostheses. The differences in usage follow those relating to the hip joint and upper end of the femur and are also illustrated in this report.

The discussion paper prepared by ISO/TC 150/WG 1 also suggested that the terms 'valgus' and 'varus' should be discarded and alternative terms used. The alternative terms proposed were 'abduction' and 'adduction'. Two arguments were thrown up against the use of these terms: firstly that the terms related to movement and not to deformity, and secondly, and perhaps more importantly, the terms were so similar that error could easily creep in during dictation or transcription.

With regard to the first objection, namely that the terms relate to movement and not fixed deformity, it should be noted that deformities in the sagittal plane are called 'flexion' or 'extension' deformities and these terms are also used in relation to movement. Thus, in this respect there is no real objection to the use of the terms 'adduction' and 'abduction'. However, the concern about the two terms being so similar is of considerable importance and would appear to be a definite drawback.

This Technical Report has been produced because of the significant international differences in the use of the terms around the hip joint. It does not appear that complete consensus will be reached in the foreseeable future, nor is it likely that the use of the terms will be discontinued, so it is important for all those working in the field of orthopaedics to beware of these differences.

It is strongly urged that authors should carefully define their usage of 'valgus' and 'varus' whenever they use these terms in published work concerning the hip joint and upper femur. Clinical teachers should draw the attention of their students to the anomalies and doctors should be aware of the problem when transferring patients from country to country. A simple drawing is probably the safest way of transmitting the information.

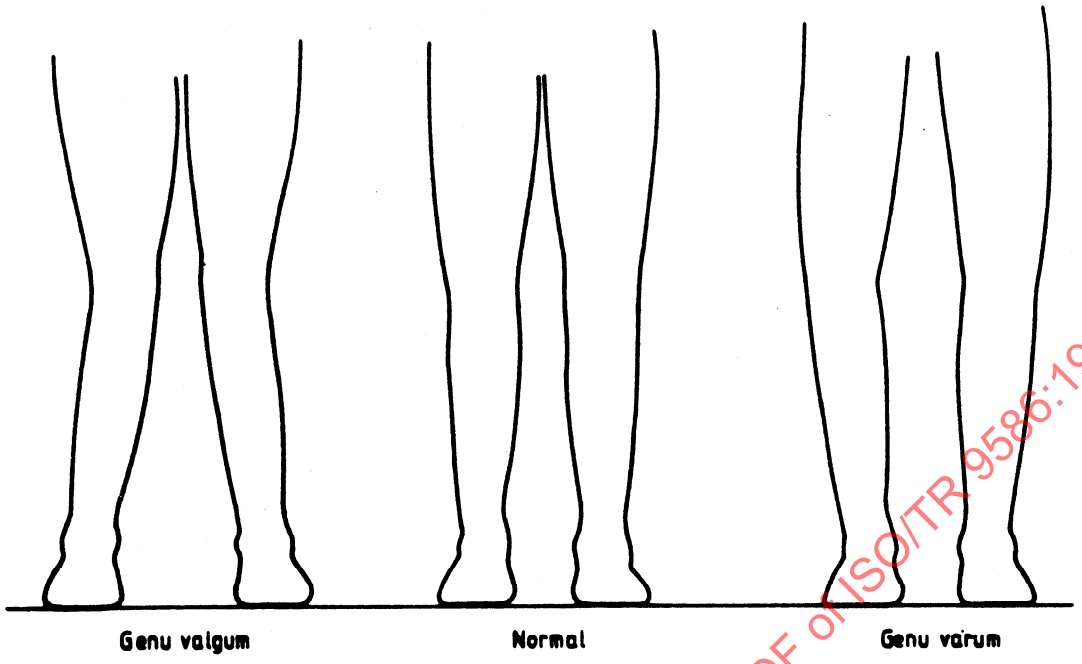

Figure 1(a). Illustration of valgus and varus deformity centred on the knee joint, the deformity being in the coronal plane

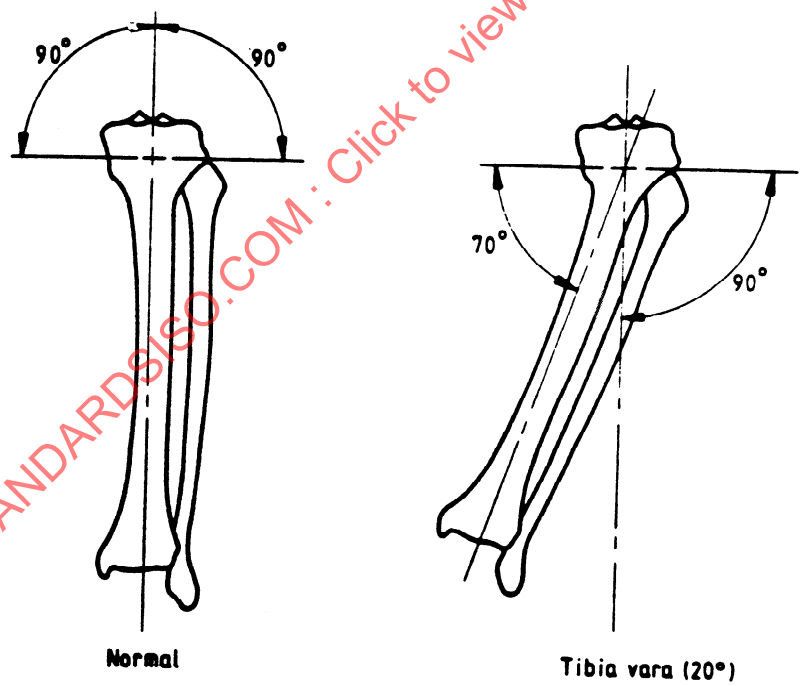

Figure 1(b). Illustration of varus deformity occurring within a long bone - the tibia

Figure 1. Illustration of varus and valgus deformities

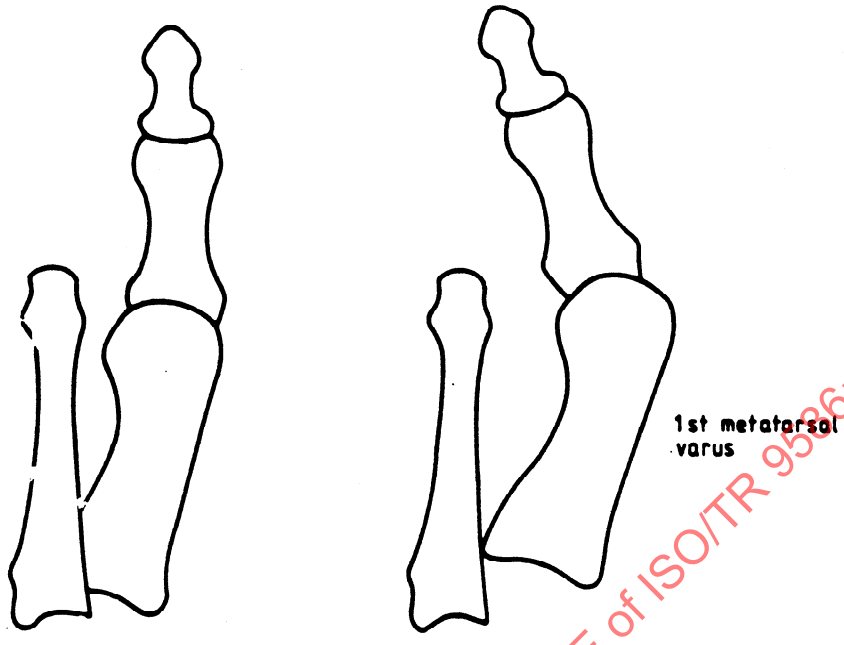

Figure 2(a). Normal

Figure 2(b). Hallux valgus

Figure 2. Illustration of hallux valgus deformity showing the associated varus deformity of the first metatarsal