
Let's Talk about the Terms

Hello, readers. I guess if you are stopping in at this site, you share either my interest in or concern for the issue of nomenclature in our professional publications and communication. (Or maybe you're just curious to see what that Cusick is up to now....)

Searching for developmental musculoskeletal norms and trends, I've cast a wide net across several clinical disciplines. I discovered that most normative studies lack a rigorous application of the fundamental research principles of replicability of the study, inter-rater reliability, and established validity. A significant and related problem is the lack of standardization of both the terminology and of assessment methods.

The persistent use of nonstandardized, vague, or inaccurate nomenclature to describe pathomechanical and pathokinesiographical conditions has contributed to several difficulties that might be alleviated with more clarity and consistency. For example, I've experienced nomenclature-related difficulties in the following endeavors:

- Identifying and communicating clinical observations and concerns
- Achieving acceptable levels of reliability and validity in the execution of numerous musculoskeletal assessments
- Acquiring meaningful normative data from published literature
- Searching for topic-related information in the literature.

Illustrating the last point, for example, the term **metatarsus adductus** seems to universally describe a medially-directed alignment of the metatarsals, occurring in the transverse plane. However, **hallux valgus** is commonly used to describe a hallux that deviates laterally (abducts) in the (same) transverse plane. The accurate descriptor for an abducted hallux is **hallux abductus**. A comprehensive literature search for information about hallux abductus must currently include both descriptors, though one of them is incorrect.

The following terms are often used interchangeably, though they describe distinctly different phenomena:

Torsion -- A feature of osseous geometry
Version -- The act of turning or deviating
Rotation -- A motion that occurs about an axis.

To address this long-term problem of discrepancies in the use of one group of terms, the Pediatric Orthopaedic Society's Subcommittee on Torsional Deformity - headed by Lynn T. Staheli, MD - compiled and published a list of terms and definitions. The author introduced the list with an invitation to other societies and organizations to offer input that could lead to changes. Since no society or organization has apparently done so in the past 20 years, I'll step up to the plate with the following questions and suggestions for improving the accuracy and clarity of many of the definitions that the subcommittee has so far agreed to recommend.

I copied the subcommittee's list verbatim from the publication, dividing the terms and statements into numbered paragraphs for reference by readers, and for addressing questions to those terms or statements that provoke them. If a numbered paragraph is not followed by a question or suggestion, then the reader may surmise that I do not challenge or contend it. All of my comments are italicized and indented, and follow the terms or statements that warranted discussion in my opinion. You are welcome to participate in this discussion, of course.

Thanks for your interest. I look forward to hearing from you.

"Billi" (Beverly) Cusick, PT, MS

Report of The Pediatric Orthopaedic Society Subcommittee on Torsional Deformity.

Page 64...

"Discussions are in reference to the transverse plane (tp) with the subject in anatomical position."

PP#1. The **line of progression** is the longitudinal line between the footsteps during ambulation. The primary reference

planes are:

1. The mid-sagittal plane of the body
2. This plane extended along the line of progression, designated as zero degrees.

Suggested correction or addition: The line of progression represents the forward progress of the center of the body mass while ambulating on a level surface.

PP#2. The terms **torsion**, **varus**, and **valgus** describe deformity.

Dorland's Medical Dictionary (1982, p.604) defines torsion as follows: "Act of twisting: state of being twisted." The Oxford English Dictionary (1991, p.2083) defines torsion as: "The action of twisting, or turning a body spirally by the operation of contrary forces acting at right angles to its axis; also the twisted condition produced by this action; twist."

Why would the term "torsion" now apply only to an abnormally-twisted bone, and not to the same bone that is normally twisted in the same direction?

Suggested correction: Use descriptors, such as excessive or diminished, and either medial or lateral, to discriminate between a normally twisted and an abnormally twisted bone.

Varus (*vara, varum*) - a status of medial deviation in the frontal-plane (a.k.a. inversion or adduction) of a segment distal to a joint, or to the proximal end of the same segment - occurs normally in development, at the knee joint (*genu varum*), the subtalar joint in full congruity (*subtalar varus*), and the infant's forefoot in full joint congruity (*forefoot varus*).

Valgus (*valga, valgum*) - a status of lateral deviation in the frontal-plane (a.k.a. eversion or abduction) of a segment distal to a joint, or to the proximal end of the same segment, occurs normally in development at the proximal femur

(coxa valga) and the knee joint (genu valgum).

Normally-occurring alignment features are not deformities.

Therefore, when varus and valgus occurs in excessive or diminished magnitude for age and sex, the more accurate descriptor could be "increased" or "diminished" varus(um) or valgus(um). When varus or valgus is not expected to occur at a particular age, the same term applies to the same alignment condition nonetheless. Genu varum at age 24 years or 12 months is still genu varum, a malalignment at age 24 years, and a normal feature of alignment at age 12 months.

PP#3. The terms **adduction**, **abduction**, **rotation**, and **version** describe position, direction, or motion.

Suggested correction: Words ending in "ion" describe a motion in progress. The same words ending in "ed" describe a resulting position. None of these words can describe a direction in which a motion occurs without an accompanying planar orientation.

*Example: at the hip and shoulder, the terms **adduction** and **abduction** describe frontal-plane motions toward and away from the midline of the body, respectively. In the foot, the same terms describe transverse-plane motions toward and away from the midline of the body, respectively.*

***Version** pertains to an act of turning, directing, or deviating, but has no direction without a prefix such as "e"version (turning laterally), "in"version (turning medially), "ante"version (turning forward), or "retro"version (turning backward).*

PP#4. The position of the deformity is described in reference to the anterior, midline plane.

Where is this anterior, midline plane? Does this mean that the anterior aspect or surface of the segment is described in terms of its orientation

to the midsagittal plane?

PP#5. The terms **medial** and **lateral** are preferable to internal and external, as the latter are often used to describe that which is inside or outside.

PP#6. **Normal** is defined as that which falls within 2 SD of the mean.

Suggestion: First examine the investigative methods and data collection systems by which all reported means were acquired. And remember, most elderly people with widespread degenerative joint disease, painful bunions, chronic knee pain, patellofemoral dysfunction, knee and hip joint replacements, etc... were once "normal" children.

PP#7. **Objective disability** is present if the time or energy requirements to perform a certain task is increased over normal.

Increased by more than 2 SD?

PP#8. **Subjective disability** is defined as a deviation in appearance that evokes a negative response.

Whose negative response?

PP#9. The **foot axis** extends from the midpoint of the heel to the midpoint of the forefoot at the level of the metatarsal heads.

Does the "midpoint of the heel" mean the center of the heel pad, or the center of the posterior border of the heel pad?

What is the midpoint of the forefoot? Metatarsal head #3?

What if there is a structural or dynamic forefoot or metatarsus adductus? Would this foot axis have to bend on its way to the metatarsal heads? Or would the foot axis fall lateral to metatarsal head #3 in this case?

Bleck (1982) described the (rectus) foot axis as a line bisecting the plantar heel pad and

extending through the second and third metatarsal heads. I would add that in the presence of adductus of either the metatarsals or the entire forefoot (originating at the midtarsal joint), the same heel bisection falls through or lateral to the third toe.

While conducting a foot print study to determine FPA, I suggest dividing the footprint - toes excluded - into 3 equal sections longitudinally, and then longitudinally bisecting the heel section. Use only the heel bisection to represent the entire foot axis, as it can most directly reflect the influence of the proximal segments on the foot progression angle (FPA) in gait.

If the forefoot of the footprint is adducted or abducted at either the midtarsal or the tarso-metatarsal (Lisfranc's) joint, the longitudinal bisection of the related sections of the footprint would lie between and parallel to metatarsal shafts #2 and #3.

The average FPA would be derived from the collected measurements of the inclination of the heel bisection to the line of progression.

The average forefoot angle would be recorded separately as FPA-FF, to account for the forefoot deviation as a component of the overall FPA.

Example: *A child with spastic supination deformity, with a component of significant forefoot (midtarsal joint) adductus, might appear to walk with an intoed gait. However, the footprint study reveals that the heel bisection of the same foot shows a lateral FPA while only the forefoot shows a medial FPA. It would therefore be expected that by restoring forefoot abduction ROM, the intoed gait pattern would at least resolve, or even change to an out-toed pattern.*

PP#10. The **Foot Progression Angle** (FPA) is the angular difference between the foot axis and the line of progression. This may be either measured (sub M) or estimated (sub E). As this is variable, it should be

averaged in stance phase unless otherwise specified.

How many measured prints are needed to produce a statistically-viable average? I heard 24 prints per foot for a child with cerebral palsy. Does anyone have the source for this number?

A visually-estimated average of the FPA offers no contribution to a comparative data base or outcome measure, and should be discarded in anything but a subjective clinical gait evaluation.

PP#11. Intoeing is a medial FPA beyond the normal range (for age and sex) designated with a minus (-) sign before the value.

Does this mean 2 SD beyond the mean?

PP#12. Out-toeing is a lateral FPA beyond the normal range (for age and sex) and designated with a plus (+) sign.

Does this mean 2 SD beyond the mean?

PP#13. Structural deformity may involve any or all bony or soft tissue elements.

Any or all? Wow! I wonder if this definition could be made more specific.

PP#14. Dynamic deformity is secondary to muscle imbalance.

Suggested addition: "...and is evident in the context of movement. Dynamic deformity resolves when the body is at rest."

PP#15. Intoeing or **out-toeing** may result from torsion at one or more segments.

Suggested correction: Intoeing or out-toeing may result from excessive or diminished torsion at one or more segments.

PP#16. Compensation exists if medial and lateral torsion exist at different segments.

Suggested addition: "...and if the foot exhibits related pronatory or supinatory deviation. Example, the expected intoed gait in the presence of increased medial femoral torsion may be compensated by either excessive lateral

tibiofibular torsion or excessive foot pronation, or both. The result of the combined and compensatory malalignments may be the absence of a notable deviation in FPA."

PP#17. Summation exists if medial or lateral torsion is present at different segments.

Suggested addition: "...For example, Child A's left intoed gait is the consequence of the sum of 3 elements. The femur exhibits increased antetorsion (medial torsion); the tibiofibular segment exhibits diminished lateral torsion; and the foot displays metatarsus adductus. "

PP#18. Torsional malalignment may exist in a compensated torsional deformity, resulting in an abnormal axis of joint motion relative to the line of progression.

Suggested correction: Torsional malalignment may exist in either an un-compensated or a compensated torsional deformity, whereby a related axis of joint motion lies in abnormal position relative to the line of progression.

PP#19. Ankle axis (*tp*) is the line through the axis of rotation of the tibial-talar joint. Anatomically this axis lies between the tips of the malleoli.

The "tibial-talar" joint is usually referred to as the talocrural (talus-leg) joint.

The "ankle axis" is also described as the "transmalleolar axis" (TMA), and though it lies inclined about 20° in lateral rotation to the frontal plane of the body when viewed from above or below the segment, it also lies about 10° inverted to the transverse plane on an anterior-posterior view.

Suggested correction: This aspect of the TMA might be more clearly described as the overhead view of the TMA.

PP#20. Talipes varus/valgus (*tp*) is an abnormally increased angle between the axes of the ankle and foot.

If this definition pertains to a transverse-plane condition, why would the terms varus and

valgus pertain to frontal-plane alignment features at the proximal femur (coxa vara/valga), the knee joint (genu varum/valgum), the ankle joint (ankle valgus), the subtalar joint (subtalar varus/valgus), and the midtarsal joint combined with the first ray (forefoot varus/valgus)?

*Suggested correction: Since adductus is already used universally to describe a medial deviation of the metatarsals in the transverse-plane (metatarsus adductus), use **talipes adductus/abductus** to identify the transverse-plane condition described in this definition.*

Talipes varus/valgus more accurately describes the frontal-plane status of alignment in inversion/eversion respectively. For example: a metatarsus adducto-varus deformity features both transverse-plane adduction and frontal-plane inversion of the metatarsals at Lisfranc's joint, and is commonly seen as a forefoot component of talipes equinovarus deformity.

PP#21. Pes varus/valgus (tp) *is an abnormally increased angle between the axis of the calcaneus and second metatarsal. This may involve a single level or multiple levels.*

Again, pes varus and valgus historically describe frontal-plane alignments at the foot - an inverted or an everted hindfoot, respectively. Why are they used for transverse-plane deviations here?

What are "levels"? Are they joints?

Suggested correction: If the metatarsals are the only deviating segment, then this condition is better described as metatarsus adductus or abductus. If the deviation occurs more proximally than Lisfranc's joint, say at the midtarsal (talonavicular and calcaneocuboid) joint, it would be a forefoot adductus or abductus. If the second metatarsal only deviates medially or laterally, then it could be identified as the sole bone involved in the malalignment with a simple description of its orientation to the calcaneus and to the other metatarsals.

Varus and valgus are (still) frontal-plane terms throughout the lower extremities, which include the feet and toes.

Continuing on p. 65:

PP#22. Talar version is the normal angle between the body and neck of the talus.

Since this term is not followed by a (tp), it is not clear in what cardinal plane this condition occurs. If it is transverse, the mature talar neck is normally adducted about 15-20° on the talar body. If it is sagittal, then the mature talar neck is normally plantarflexed about 20-30° on the talar body. If it is frontal, then the mature talar head is normally everted between 37° and 57° on the talar body. Version means nothing without a directional prefix and a planar orientation.

Suggested correction: Use terms that explain the nature or magnitude of the condition, such as normal, excessive, or diminished talar neck-on-body plantarflexion, eversion, or adduction.

PP#23. Talus varus is an abnormal increase in medial talar version. This same terminology is used for each bone of the foot.

Again, if this definition pertains to a transverse-plane condition, why would the term varus pertain to frontal-plane alignment features at the proximal femur (coxa vara), the knee joint (genu varum), the subtalar joint (subtalar varus), and the midtarsal joint combined with the first ray (forefoot varus)?

Suggested correction: Since adductus is already used universally to describe a medial deviation of the metatarsals in the transverse-plane (metatarsus adductus and metatarsus primus adductus), use "increased" or "excessive" talar neck-on-body adductus to identify the transverse-plane condition described in this definition.

PP#24. Tibial version is the normal angular difference between

the transcondylar axis of the knee and the transmalleolar axis of the ankle.

If the term "tibial version" is intended to describe normal tibiofibular torsional geometry in the transverse plane, why is the transcondylar axis (TCA) of the distal femur included as the tibiofibular proximal reference axis?

Is the relationship of the transmalleolar axis (TMA) to the TCA observed with the knee joint extended or flexed 90°?

Does "tibial version" refer to a rotational deviation of the entire tibiofibular segment distal to the femur?

*Furthermore, **version** is defined by Dorland's Medical Dictionary (1982, p.649) as: "Act or process of turning or changing direction." What does "version" mean anatomically without a prefix that assigns a direction or orientation, such as inversion, eversion, anteversion or retroversion?*

Is version a condition of only lateral rotational or torsional deviation in this definition?

Suggested correction: If this condition is one of tibial axial rotation occurring within the knee joint, and it is likely that the fibula is involved, this condition would be more accurately described as tibiofibular axial rotary alignment, and an increased medial or lateral rotational deviation described as such.

If this condition is supposed to pertain to tibial torsional status, then the TCA must be rejected as a reference axis, and the term torsion should replace "version".

PP#25. Anteversion is the normal angular difference between the transcondylar plane of the knee and the neck-head plane of the hip.

If the definition of anteversion pertains to the

femur only, then are all the authors who have used the term "anteversion" to describe the acetabulum that is directed anteriorly on the pelvis incorrect?

And is "hip" now synonymous with "femur"? Isn't a hip a joint comprising a femoral head and an acetabulum?

Why is "tibial torsion" routinely (and correctly) used to describe a twisted tibia, but a similarly-twisted femur is often described (in the western hemisphere) as "anteverted"?

Suggested correction: Ante means "forward". Version means "directing, deviating or turning". Therefore, anteversion simply means "turning or directing forward".

The femoral head and neck axis can be anteverted 1° or 60°, as long as the femoral head lies anterior to the greater trochanter in a plane that intersects the frontal plane of the body. The motion of femoral rotation in the acetabulum continually alters the angle of femoral head and neck anteversion. Medial rotation reduces the angle of anteversion. Lateral rotation increases it. A newborn child with 40° of femoral anteversion, and who normally rests with the hips flexed and the TCAs aligned in about 20° of lateral rotation to the frontal plane, maintains the femoral head and neck in 60° of anteversion in that position (40° of anteversion + 20° of lateral femoral rotation. At any age, the same femur, when rotated medially or laterally, exhibits less or greater momentary head-and-neck anteversion respectively, while the torsional geometry remains unchanged.

PP#26. Femoral torsion is an abnormal increase in femoral anteversion or retroversion.

Once again, torsion is defined as either the action of twisting, or turning a body spirally by the operation of contrary forces acting at right angles to its axis; or the twisted condition

produced by this action. How can a femur with normal (ante)torsion (twist) be described as anteverted (directed forward), and one with excessive medial torsion be described as exhibiting torsion (or more accurately, antetorsion), both of which occur in normal magnitudes in the human lower extremity?

The skeletal modeling process diminishes femoral antetorsion, such that if the femoral TCA were constantly aligned on the frontal plane, the femoral head and neck are normally anteverted by some magnitude that diminishes from approximately 40° at birth to approximately 16° in adulthood.

Therefore, the same femur is better described as exhibiting antetorsion - a state of twist about the longitudinal axis of the femur leaving the head and neck axis directed forward by a measurable angle when the TCA is aligned on the frontal plane.

As long as the TCA is aligned on the frontal plane, the magnitude of antetorsion equals that of femoral head-and-neck anteversion.

Should a femur exhibit a backward deviation (retroversion) of the axis of the head and neck relative to the TCA that aligns on the frontal plane, the geometry of the bone is described as retrotorsion, which is considered a deformity at all ages. A femur with diminished antetorsion does not exhibit retrotorsion. Retro means backward.

If the axis of the femoral head and neck align parallel with the TCA, the torsional magnitude is zero. If a femur with 0° of torsion is present in an ambulatory adult, the TCA is typically rotated laterally about 15° in stance and gait; along with the femoral head-and-neck axis - which anteverts the same amount - to restore a competent load-bearing alignment of normal anteversion at the hip joint.

Suggested correction: The abnormally twisted femur is more clearly and accurately described as exhibiting excessive or diminished antetorsion, or retrotorsion.

PP#27. Hip rotation as measured in the anatomical position is either medial or lateral in direction. The sum of medial and lateral hip rotation is termed "the excursion."

PP#28. Acetabular anteversion is the normal inclination of the acetabulum in reference to the sagittal plane.

If the normal plane of the brim of the adult acetabulum is anteverted about 17° in the transverse plane (measured relative to the sagittal plane), then why not describe 30° of anteversion as "increased anteversion" and 5° as "diminished anteversion" of the acetabulum?

PP#29. Acetabular torsion is an abnormal inclination and may be medial or lateral.

In what plane might acetabular torsion, medial or lateral, occur? Torsion refers to a twisted state. Is this a twisted acetabulum?

Suggestion: discard this term. Torsion means twisting or twisted. If it is supposed to describe excessive or diminished acetabular anteversion, the latter terms are more clear and accurate.

Suggested correction: Since acetabular anteversion can occur in normal and abnormal magnitudes, use the same term to describe the same directional orientation, and add descriptors such as "normal", "increased", or "diminished" acetabular anteversion.

If the plane of the acetabular brim is directed frankly backward, then the term "retroversion" applies. Diminished acetabular anteversion is not synonymous with acetabular retroversion. Retro means posterior.

PP#30. Standardized measurement techniques were recommended utilizing clinical examination methods wherever possible, rather than radiologic methods."

(End of article)

I'll also gladly engage readers in a discussion that strives to standardize and improve the accuracy of the professional language shared by all disciplines involved in lower extremity orthopedics and rehabilitation. (If 2000 of you write in to try to convince me to go with the flow of ignorance, I will inevitably refuse to agree. You might convince each other, but I've repeatedly seen the failures when vaguely-defined and poorly-understood concepts and diagnoses are clinically applied and will not be swayed by anything but a more accurate definition of a term than I've been able to conjure up here.)

After struggling more than 15 years with this difficulty in my own work and writing, I wrote Lower Extremity Developmental Features, the first monograph of the APTA Orthopedic Section's **In-Touch Home Study Course #10.2: Orthopedic Interventions for the Pediatric Patient (1999)**. For this effort, I used terms that can be supported by simple definition and by the meaning of Latin base words or components, and, where possible, that align consistently with comparable terms throughout the body.

For information about ordering the In-Touch Home Study Course, please contact the [Orthopaedic Section, APTA, Inc.](#), 2920 East Avenue South, Suite 200, La Crosse, WI 54601 (800-444-3982/ FAX: 608-788-3965) or browse the [list of available courses](#). (At press time, the Cusick course wasn't listed yet; contact tfred@centuryinter.net to remind them!)

If you're interested in upcoming Cusick course information, go to <http://www.gaitways.com/bcsked.html> for the latest known teaching dates. If you'd like to order a copy of the 2-hour instructional videotape entitled **Legs & Feet: A Review of (30) Musculoskeletal Procedures** (1997, reprinted in 1999), please print out the [order form](#) and fax it to (888) 634-0495 toll free.

Thank you again for your camaraderie in this struggle for clearer language and thinking! Let's [hear from you!](#)

Billi Cusick