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Review Article

The American College of Foot and Ankle Surgeons® Clinical Consensus Statement: Hallux Valgus

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This document was created to serve as one of a series of clinical consensus statements (CCS) sponsored by the American College of Foot and Ankle Surgeons® (ACFAS) (1-8). It is important to appreciate that consensus statements do not represent clinical practice guidelines, formal evidence reviews, recommendations, or evidence-based guidelines. Instead, a CCS reflects information synthesized from an organized group of experts based on the best available evidence. Still, it also may contain, and to some degree embraces, opinions, uncertainties, and minority viewpoints. A CCS should open the door to discussion on a topic, as opposed to providing definitive answers.

In 2003, Smith and Pell published what could only be described as a sarcastic systematic review of randomized controlled trials examining the effectiveness of parachutes in preventing death following jumping out of airplanes (9). As they were unable to identify any Level 1 evidence on the topic, their only possible conclusion within the modern paradigm of evidence-based practice was that parachutes could not be proven to prevent death following free fall. They even went so far as to encourage the proponents of evidence-based medicine to organize and participate in a double-blind, randomized, placebo-controlled, crossover trial of the parachute! Their broad point was that there is not always high-level evidence for all clinical situations and therapeutic interventions, so some amount of common sense is required in contemporary medical practice. We feel that this also represented our primary theme during the construction of this CCS: an attempt to develop consensus on a broad range of topics relevant to the clinical practice of foot and ankle surgeons as it relates to the hallux valgus deformity utilizing not only the best available evidence but also a degree of our clinical experience and common sense.

Adherence to consensus statements will not ensure successful treatment in every clinical situation, and individual physicians should make their ultimate decisions based on all available clinical information and circumstances with respect to the appropriate treatment of a particular patient. This CCS is on the topic of the adult hallux valgus deformity, and its purpose is an attempt to address some of the more common preoperative, intraoperative, and postoperative considerations facing foot and ankle surgeons in contemporary practice.

Materials and Methods

Creation of Panel

Believing that the creation of CCS would be beneficial to its members, ACFAS enacted an initiative to create such documents for foot and ankle surgeons. This initiative was initially conceived to report on a variety of topics and take the place of previous clinical practice guidelines (1-8). To move forward with this initiative, a formal consensus method process was undertaken. Eight experts in the field of foot and ankle surgery were sent an invitation by ACFAS to participate on a panel to develop a CCS on "hallux valgus," hereafter abbreviated as "HV" in this manuscript. All accepted, and the 8-member panel was convened and tasked with reviewing the medical literature and providing opinions regarding this topic. The panel

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was chaired by one member (A.J.M.) and assisted by ACFAS members and staff. Over a 12-month period, panel members participated in an email dialog, conference calls, and a virtual face-to-face meeting. The stated goal of the panel was to develop and subsequently consider consensus on a series of clinical statements on the topic of the HV deformity that might be of interest and value to foot and ankle surgeons, examine the current literature relating to these statements, and synthesize both this information and our opinions for ACFAS members and *The Journal of Foot and Ankle Surgery®* readers.

Development of CCS Questions

Our first task was the development of a series of CCS questions for inclusion. The topic of HV is a broad one, and any number of subtopics and specific statement questions might be derived from it. Initially, through ACFAS member survey feedback, our collective clinical experiences, and the results of an open discussion during an introductory conference call, we developed a preliminary list of approximately 15 broad topics within the realm of the HV deformity to be considered for consensus statement question development and inclusion in this CCS.

Formal Literature Review

Literature reviews and brief synopses were then performed by panel members and included searches in Medline®, EMBASE®, the Cochrane Database of Systematic Reviews, foot and ankle surgical texts, and other relevant resources. While this was not a formal systematic review process, each panel member was charged with conducting thorough literature searches in an attempt to answer specific questions on each topic.

Consensus

A modified Delphi method was then used to attain consensus on the clinical questions by members of the panel (10). A definitive series of 13 statement questions was eventually developed by the panel chair and sent to all panel members to review and answer (Table). The answers were based on the appropriateness of the statement question and were graded from 1 (extremely inappropriate) to 9 (extremely appropriate) on a Likert scale (11). Each panel member answered the questions anonymously, and the results were sent to the panel chair. The answers were reviewed, analyzed, and grouped from 1 to 3 (inappropriate), 4 to 6 (neither inappropriate nor appropriate), and 7 to 9 (appropriate). The results were summarized with basic descriptive statistics, kept anonymous, and reported back to panel members. At the virtual face-to-face meeting, the questions and initial consensus results were reviewed and opened for discussion. Although an attempt was made to reach a consensus for all questions, it was not a requirement, and in fact, contrary opinions were encouraged. All panel members participated in the creation of this CCS manuscript, the final draft of which was subsequently submitted to the ACFAS leadership for adoption and submitted to *The Journal of Foot and Ankle Surgery®* for publication.

Results and Discussion

Table. Clinical statements and consensus results

Evaluation considerations

[1] The hallux valgus deformity should be considered a chronic, progressive, and degenerative condition.
1 2 3 4 5 6 **7** **8** **9**
Extremely inappropriate Extremely appropriate

[2] The juvenile hallux valgus deformity should be evaluated and managed differently than the adult hallux valgus deformity
1 2 3 4 5 6 **7** **8** **9**
Extremely inappropriate Extremely appropriate

[3] The natural course of the hallux valgus deformity might be interrupted with nonsurgical intervention. **NO CONSENSUS**
1 2 3 4 5 6 7 8 9
Extremely inappropriate Extremely appropriate

[4] Effective assessment of the hallux valgus deformity requires radiographic evaluation.
1 2 3 4 5 6 **7** **8** **9**
Extremely inappropriate Extremely appropriate

[5] The presence of first ray hypermobility directly affects the prognosis of the hallux valgus deformity as well as intervention outcome. **NO CONSENSUS**
1 2 3 4 5 6 7 8 9
Extremely inappropriate Extremely appropriate

Perioperative considerations

[6] Procedure selection for hallux valgus should be based on the severity of the deformity. **NO CONSENSUS**
1 2 3 4 5 6 7 8 9
Extremely inappropriate Extremely appropriate

[7] Procedural decision making for hallux valgus should address the specific pathoanatomy of the deformity.
1 2 3 **4** **5** **6** 7 8 9
Extremely inappropriate Extremely appropriate

[8] Hallux valgus should only be addressed surgically with joint preserving procedures.
1 **2** **3** 4 5 6 7 8 9
Extremely inappropriate Extremely appropriate

[9] There is no role for biologic augmentation in the surgical correction of hallux valgus.
1 2 3 **4** **5** **6** 7 8 9
Extremely inappropriate Extremely appropriate

Postoperative Considerations

[10] The outcome of hallux valgus surgical correction is independent of procedure selection.
1 2 3 4 5 6 **7** **8** **9**
Extremely inappropriate Extremely appropriate

[11] The postoperative course for hallux valgus should involve a period of non-weight-bearing immobilization. **NO CONSENSUS**
1 2 3 4 5 6 **7** **8** **9**
Extremely inappropriate Extremely appropriate

[12] Physical medicine and rehabilitation interventions should be considered for patients undergoing hallux valgus surgical correction.
1 2 3 4 5 6 **7** **8** **9**
Extremely inappropriate Extremely appropriate

[13] The postoperative evaluation of hallux valgus should include an assessment of functional outcome measures.
1 2 3 **4** **5** **6** 7 8 9
Extremely inappropriate Extremely appropriate

Evaluation Considerations

[1] Consensus statement: The panel reached a consensus that the statement "The hallux valgus deformity should be considered a chronic, progressive, and degenerative condition" was appropriate.

The underlying mechanisms supporting the adult HV deformity as both a "chronic" and "progressive" condition appear to follow a relatively predictable dynamic pathoanatomic course that has been established and broadly accepted for decades. Many comprehensive reviews are available which detail this underlying biomechanical pathogenesis and describe the potential effects of associated variables including but not limited to age, gender, heredity, shoegear, metatarsal morphology, ligamentous laxity or failure, equinus, pronation, medial column hypermobility, and metatarsus adductus (12-65). With that said, it is likely more appropriate from a critical analysis of the medical literature standpoint to consider these as potential associations, as opposed to direct correlations based on the inherently cross-sectional, observational, and retrospective study designs leading to these conclusions.

Perhaps interestingly, relatively little is definitively known about the specific progression of the deformity secondary to a lack of prospective longitudinal analyses. Clinical experience tells us that the deformation tends to progress or worsen with time, and there is some indirect evidence of a so-called “tipping point” of the deformity where retrograde musculoskeletal deforming forces might become more pronounced (66). However, most deformities also appear to progress to a relatively stable end-point. In other words, the majority do not continually worsen in perpetuum, but instead seem to eventually reach a steady-state plateau. Although there are certainly examples of hallux abduction reaching an anatomic limit completely underneath the lesser digits and hallux valgus angles approaching 90 degrees, these are exceptions and not the norm, and might be most common in specific situations of inflammatory and destabilizing arthropathies such as rheumatoid arthritis (67-69). Developing a clearer understanding of the specific longitudinal progression of the structural aspects of this deformity would likely be of substantial clinical value with respect to patient education of expectations and determination of the optimal timing for surgical intervention.

Also related to this discussion of deformity progression is the association between structural deformity, pathoanatomy, and clinical symptomatology. This appears to be another area where the current literature body cannot support a direct or reliable correlation. Some authors have ascribed subjective symptoms associated with specific pathoanatomic findings, including, but not limited to, the medial eminence rubbing in shoegear, local neuritis, bursitis, intra-articular degenerative changes, transfer metatarsalgia, and callus formation (12,16,17,21,25,26,30,32,35,36,40,41,55,57,61). These are all correlative and intuitive to some degree based on the anatomic proximity to the joint. With that said, it is not uncommon in clinical practice to evaluate relatively mild structural deformities leading to severe patient symptoms, as well as severe structural deformities that present without symptoms or any subjective patient complaint whatsoever (70-74). This apparent paradox remains unexplained when considering the purported pathoanatomical pain mechanisms and underscores the importance of developing mutual expected outcomes between patients and surgeons before operative intervention (74−76).

The panel had some discussion on the inclusion of the specific term “degenerative” within this consensus statement. Although general degenerative changes and osteochondral lesions of the first metatarsophalangeal joint are typically associated with the hallux limitus and rigidus deformities, there is undoubtedly clinical empirical evidence of an arthritic component to the HV deformity as well. For example, osteochondral lesions have been identified in a majority of patients undergoing HV surgical correction, with mixed findings of a potential association with the severity of the deformity (77-85). Jastifer et al have proposed that these lesions' presence might contribute to patient dissatisfaction with surgical correction despite proper musculoskeletal realignment (77). The etiological similarities and differences between the HV and hallux limitus/rigidus deformities represent another interesting potential avenue for future investigation (86).

***[2] Consensus statement*: The panel reached a consensus that the statement “The juvenile hallux valgus deformity should be evaluated and managed differently than the adult hallux valgus deformity” was <u>appropriate</u>.**

The panel recognized and agreed that the pediatric or juvenile HV deformity presents a unique set of characteristics and considerations in comparison to the adult deformity. These might include reduced medial soft tissue hypertrophy, limited medial metatarsal head eminence, reduced valgus orientation of the hallux, more frequent presence of hypermobility, relative plasticity of immature bone, the presence of an open physis at the proximal first metatarsal, and an increased association with other medical conditions including, but not limited to, Down syndrome, connective tissue disorders, juvenile rheumatic disease, and neuromuscular disorders such as cerebral palsy (58,87-102). Perhaps interestingly, a reference to this deformity as “hallux valgus” might not be entirely accurate, as there are seldom adaptive changes in the frontal plane with the pediatric presentation. Therefore, a better descriptive term might be “pediatric bunion,” “metatarsus primus varus,” or “metatarsus primus adductus,” among others.

The radiographic evaluation of the pediatric bunion shares many similarities to the adult deformity albeit with several potentially critical distinguishing features that might affect procedure selection. These include the presence of a relatively long first metatarsal, pronounced lateral deviation of the cartilage on the first metatarsal head, an abnormally flat or conically shaped first metatarsal head, marked varus obliquity of the first metatarsal-medial cuneiform articulation, and an increased incidence of metatarsus adductus potentially underestimating the “true” intermetatarsal angle (96-101). Taken together, these might point to a more significant structural component to the deformity in the pediatric patient as opposed to a more functional one in the adult.

Given the high rates of deformity recurrence that have historically been reported following surgical correction of the pediatric bunion, proximal procedures achieving more anatomic intermetatarsal angular correction are generally recommended. These include the first metatarsal-medial cuneiform arthrodesis, closing base wedge osteotomy, opening base wedge osteotomy, double osteotomy, and proximal crescentic osteotomy among others described in the literature (102-120). With that said, the presence of an open physis should undoubtedly influence not only procedure selection but also the timing of surgical intervention. Kelikian reported that the proximal first metatarsal physis closes around 13.7 years for females and 15.6 years for males (102,103). This unique anatomic consideration further introduces the possibility of early intervention with the lateral hemiepiphysiodesis technique versus waiting for skeletal maturity in order to proceed with a more definitive intervention.

Even with these relatively aggressive proximal surgical approaches, distal procedures should not be underestimated in their ability to correct for abnormal metatarsal length and cartilage deviation, whether performed alone or in combination with a proximal procedure. Two of the more commonly reported complications in this cohort, recurrence and joint stiffness, might be most directly addressed with distal procedures (104-107,117).

***[3] Consensus statement*: The panel was <u>unable to reach a consensus</u> on the statement, “The natural course of the hallux valgus deformity might be interrupted with non-surgical intervention.”**

It is certainly likely that a variety of nonsurgical interventions, including but not limited to orthotics, splinting, padding, shoegear modification, and exercise programs, might have positive effects on patient symptomatology when considering HV. It remains unclear, however, if any of these interventions have substantive long-term effects on the underlying structure to alter, slow, or stop deformity progression. The panel felt it was important for both foot and ankle surgeons and their patients to have reasonable expectations with respect to these interventions and to realistically appreciate what they might, and might not, be able to affect.

As a simple matter of architecture, the physical position of the first metatarsal and hallux in the setting of HV cannot be considerably normalized without physically altering the underlying pathoanatomy. Consequently, the primary benefit of orthotic management likely lies in the ability to control dynamic stresses that would otherwise exacerbate local symptoms about the metatarsophalangeal joint (121−123). Several investigations into the effect of orthotics on HV have concluded that there is no change in the objective structural aspects nor deformity progression, but that there might be some improvement in subjective pain and symptoms (124-129). Further, a prospective randomized trial evaluating the influence of orthotics on HV in a juvenile population found that both the experimental and control groups demonstrated deformity progression (130). And as both the onset and development of HV were observed in previously unaffected feet despite the use of an orthotic, this investigation raises a valid inquiry of what external control might be offered to adults with longer-standing deformities. Another prospective controlled study by Torkki et al randomly assigned patients into 3 groups: surgical correction, custom orthotic, and control. While the surgical patients reported less pain at final follow-up, no differences were observed between the orthotic and control groups (128,129).

Similar results have been noted with other nonsurgical interventions, including dynamic splinting, padding, and exercise programs (131-134). Although potentially with positive effects on subjective symptoms, little long-term improvement is noted with respect to radiographic or functional outcomes with nonsurgical interventions.

***[4] Consensus statement*: The panel reached a consensus that the statement "Effective assessment of the hallux valgus deformity requires radiographic evaluation" was appropriate.**

There can be little doubt that radiographic evaluation plays some role in both the clinical and perioperative assessment of the HV deformity. Specific parameters, including the first intermetatarsal angle, hallux valgus angle, and tibial sesamoid position, have not only been widely utilized for decades, but have also served as the foundation for determining deformity severity and procedure selection in educational models. As an example, one recent survey reported that a majority of surgeons routinely and objectively measured radiographic parameters during the assessment of HV, and of these, 100% evaluated the first intermetatarsal angle, and 90% assessed the tibial sesamoid position (135). Further, the previous clinical practice guideline on HV published by ACFAS in 2003 utilized transverse plane radiographic parameters as one of the primary determinants for procedure selection (36).

However, before considering the potential strengths and utility of individual measurements, it might be of some value to initially consider their limitations. First, and admittedly perhaps unorthodox for foot and ankle surgeons to contemplate, radiographic parameters are simply imaginary tools. There is no such thing as the first intermetatarsal angle, for example. It is not a tangible object found in the physical world, nor part of some underlying universal human truth. Instead, all of these measurements are simply observations of convenience that allow for a greater degree of intra- and inter-rater reliability among foot and ankle surgeons during the assessment of common conditions.

Second, our understanding of the "normal" values of these radiographic parameters is often a matter of historical convention as opposed to scientific derivation. For example, most authoritative sources and texts on HV primarily reference back to 2 so-called classic articles initially presenting basic descriptive statistics. Hardy and Clapham reported a mean first intermetatarsal angle of 8.5 degrees, but this was derived from a group of 252 teenagers who were either male naval recruits or female nurses at the Royal National Orthopaedic Hospital (58). Further, Harris and Beath reported a mean first intermetatarsal angle of 7.5 degrees, but this was derived overwhelmingly from young, healthy males recruited from the Canadian armed forces (136). Neither of these primary source investigations is likely to represent "normal" first intermetatarsal angles derived from a diverse population of ages, genders, races, and ethnicities found in contemporary medical practice. Meyr et al have more recently attempted to describe normative data from a statistical analysis of 373 feet without a history of foot and ankle surgery from an urban podiatric office, but this also likely lacks the epidemiologic breadth to be considered comprehensive (66). However, a comparison between variables did seem to provide some evidence toward a potential objective "tipping point" threshold for progressive deformity severity.

And third, it is also essential to appreciate that descriptive statistical measures such as the mean and standard deviation may not and probably do not correspond to clinical definitions such as "normal," "abnormal," "pathologic," "clinically significant," and importantly, "symptomatic." A tendency probably exists to consider patients in terms of a dichotomous "normal" versus "abnormal," when in fact a continuous spectrum is present without clear lines of demarcation (35,61,66).

In other words, radiographic parameters are likely to help describe, but not wholly define, the HV deformity. With that said, there are several measurements with which foot and ankle surgeons should feel confident concerning both calculation and interpretation. It is essential to appreciate that these are first and foremost 2-dimensional representations of 3-dimensional anatomy derived from standardized plain film radiographic projections taken in the angle and base of gait (137,138). The foundational and most widely utilized measurements describe the relationship of the first metatarsal, second metatarsal, hallux, and sesamoid complex in the transverse plane (17,18,19,26,36,37,55,56,58,60,61,66). The first intermetatarsal angle describes the angular relationship between the longitudinal bisectors of the first and second metatarsal shafts, with positive measurements less than approximately 8 to 10 degrees considered normal. The hallux valgus angle describes the angular relationship between the longitudinal bisectors of the first metatarsal and hallux proximal phalanx shafts, with positive measurements less than approximately 15 to 20 degrees considered normal. The proximal articular set angle, or distal metaphyseal articular angle, describes the angular relationship between the longitudinal bisector of the first metatarsal and the articular cartilage on its head, with positive measurements less than approximately 8 to 10 degrees considered normal. And the tibial sesamoid position describes the relationship of the tibial sesamoid to the longitudinal bisector of the first metatarsal, with a relatively medial positioning of the sesamoid considered normal.

An exhaustive list of investigations have evaluated these core measurements for their intra- and inter-rater reliability, visual approximation versus objective measurement, association and correlation between themselves and other radiographic parameters, preoperative association with surgical decision making, perioperative change following surgical correction, and postoperative association with satisfaction, functional outcome, complications, and so on (70-74,139-153). Despite this and perhaps somewhat surprisingly, it is difficult to draw definitive or consensus conclusions about them. We can conclude that more significant angular measurements are associated with increasing deformity severity. Still, there is no universal threshold ultimately defining the difference between normal/abnormal or predicting the onset of subjective symptomatology with confidence. We can conclude that a goal of surgical correction should be to restore each of these measurements to within a commonly accepted range. Still, there is no universal radiographic threshold ultimately defining intervention success or failure. And we can conclude that angular measurements provide some information about the anatomic structure of the first metatarsal-phalangeal joint. Still, they do not comprehensively describe the 3-dimensional function of the medial forefoot.

There are many other measurements that might provide foot and ankle surgeons with information about the deformity, and that might be useful in surgical decision-making. The distal articular set angle and hallux interphalangeus angle might provide information about intrinsic deformity within the hallux separate from the first metatarsal-phalangeal joint and first metatarsal (104,154-160). The relative shape of the first metatarsal head, first metatarsal length, presence of osseous cysts or articular lesions, and joint congruency might provide information about the mechanics of the first metatarsal-phalangeal joint (83,161-168). The first metatarsal head's width, presence of hypertrophy at the medial eminence, and angular relationship between the hallux and second digit might provide information more directly relating to the patient's subjective complaint (169-175). The obliquity of the first metatarsal-medial cuneiform joint and the presence of metatarsus adductus might alter the interpretation of more distal findings (176-186). Lateral radiographs, sesamoid axial radiographs, and the apparent curvature of the first metatarsal and hallux phalangeal shafts might provide information about the triplane nature of the deformity, specifically in the frontal and sagittal planes (64,187-192). And rearfoot radiographic parameters might provide information of more proximal drivers of forefoot deformity (6,17,40,60,99,193-196).

With so many individual parts potentially contributing to decision-making, it can be admittedly challenging to appreciate the entirety of the clinical picture. Nevertheless, although universal certainties might remain elusive, there can be little doubt that at least some information is derived from the radiographic evaluation of HV.

***[5] Consensus statement*: The panel was unable to reach a consensus on the statement, "The presence of first ray hypermobility directly affects the prognosis of the hallux valgus deformity as well as intervention outcome."**

The concept of the first ray (or medial column) hypermobility (or instability) continues to be one of the most investigated, potentially misunderstood, and controversial topics within the foot and ankle literature. In 2003, coincidentally the same year that the most recent statement or guideline from ACFAS on HV was issued (36), Roukis and Landsman published a comprehensive review on the concept of hypermobility, including discussions of its definition, measurement, reliability, and clinical significance as it relates to HV (197). Perhaps it is somewhat discouraging when considering scientific progress within foot and ankle surgery that their discourse remains contemporarily accurate and continues to provide a comprehensively inclusive overview of what we do (and do not) understand regarding the concept.

Most attempted definitions of hypermobility have relied on qualitative descriptions as opposed to quantitative measurements (197-209). Root's description as "abnormal dorsiflexion motion of the first metatarsal head because of the instability of the first metatarsal base" is representative of this subjectivity (198). Although generally accepted and not an unreasonable description, it does raise several potential issues when considering an evidence-based approach. First, like many of the previously discussed radiographic parameters utilized for HV, it implies a dichotomous "normal" versus "abnormal" designation when it is instead likely that a continuous spectrum of measurements exists without a clear universal threshold for pathomechanics or symptomatology (210). Second, although primarily describing the sagittal plane of the first metatarsal, it implies or assumes 3-dimensional effects. As the first metatarsal head dorsiflexes, it is assumed that both transverse and frontal plane deformity pertinent to HV increase (54,150,189-191,198,211-215). Even with objective measurement techniques for first metatarsal motion, such as the Klaue device, this triplanar motion can only be indirectly assessed (204,205). No current clinical tool or radiographic measurement has yet to adequately describe this dynamic triplane relationship. And third, the complex functional anatomy of the medial column segment is likely not entirely represented simply by "instability of the first metatarsal base" alone (41,54,198,201,211-213,216-219). For example, Fleming et al have described intercuneiform instability and its effect on HV deformity recurrence after first metatarsal-medial cuneiform arthrodesis if not appropriately addressed (220). Others have further described how distal engagement of the plantar fascia at the first metatarsal head can affect proximal metatarsal base movement through the windlass effect (197). Several investigations demonstrating an objective reduction in hypermobile findings of the first ray following distal metatarsal osteotomy provide indirect evidence in support of this (54,221).

The concept of hypermobility might best be understood within the concept of the "paradigms" popularized by Thomas Kuhn's "The Structure of Scientific Revolutions" (222). In effect, we all have the ability to choose which version of the truth is most applicable for our practices and with our patients. For some, hypermobility represents a substantial and driving pathomechanical entity that might only be addressed with a short list of interventions, including the first metatarsal-medial cuneiform arthrodesis. For others, hypermobility essentially represents an incidental finding that might be effectively addressed through a broad range of interventions. Our panel was unable to achieve consensus on which paradigm might be most appropriate for the whole of foot and ankle surgeons.

***[6] Consensus statement*: The panel was unable to reach consensus on the statement, "Procedural selection for hallux valgus should be based on the severity of the deformity."**

Traditional surgical decision-making for the HV deformity has primarily relied on transverse plane radiographic assessment for determining the so-called "severity" of the pathoanatomy. Several classification systems and treatment algorithms exist within this viewpoint, including source texts and the previous iteration of the ACFAS clinical practice guideline on HV (12,18,19,36). These have generally defined "mild," "moderate" and "severe" deformities, with relatively distal metatarsal procedures performed for mild deformities and relatively proximal metatarsal osteotomies or arthrodesis procedures performed for more severe deformities. Our panel was unable to reach a consensus if these models remain consistent with contemporary foot and ankle surgical practice. Although they certainly retain some inherent value as a general educational model, more recent evidence indicates that specific procedures likely have a more broad range of indications. Perhaps most illustrative to this discussion, minimally invasive distal metatarsal osteotomies have demonstrated efficacy with respect to radiographic and clinical outcomes for what have traditionally been considered "severe" deformities (223-234). Similarly, the first metatarsal-medial cuneiform arthrodesis has shown efficacy with respect to radiographic and clinical outcomes for what have traditionally been considered "mild" deformities in the setting of frontal plane dominant deformity or relative medial column instability (64,188,189,192).

First, it seems increasingly likely based on currently available evidence that postoperative anatomic alignment plays a more significant role in outcome than does the initial deformity severity or procedure selection. This involves a somewhat deeper understanding than an interpretation of the first intermetatarsal angle, and perhaps an understanding of both anatomic axis and mechanical axis malalignment of bone might represent a new foundation for deformity correction assessment. Retrospectively evaluating 200 radiographs, 100 with and 100 absent of HV deformity, LaPorta et al looked to identify the ideal position of the first metatarsal (149). The deformity group exhibited a first metatarsal and second metatarsal anatomic axis (i.e., first intermetatarsal angle) of 13.5 ± 2.8 degrees and a mechanical axis angle 11.58 $\pm$ 1.0 degrees. The findings in the control group were 7.5 ± 1.8 degrees and 11.19 ± 0.9, respectively. This similarity in mechanical axis descriptive statistics in feet both with and without HV indicates an operative correction target independent of the first intermetatarsal angle. These findings were confirmed to some degree by Naguib et al who noted that the mechanical axis did not substantially change following HV corrective surgery despite normalization of other traditional measurements (235).

Second, another relatively recent focus in the literature has been the effect of frontal plane deformity on transverse plane appearance. Dayton and others have argued that a transverse plane evaluation is inefficient in its assessment of the frontal plane position of the sesamoids and that supinatory rotation of the first metatarsal during surgical correction effectively corrects the position of the sesamoids and reduces the eminence of the first metatarsal head practically independent of the first intermetatarsal angle (49,64,188,189,192,236,237). Smith et al in 2018 further identified a frontal plane rotational deformity of the metatarsal in 87.3% of all HV deformities (236). While some advocate for carte blanche supination of the first metatarsal in all surgical corrections, Shibuya et al demonstrated that these radiographic projectional malalignments might not uniformly exist with inherent first metatarsal pronation, and in fact, may be driven by hindfoot pronation (187). Consequently, indiscriminate supination of the first metatarsal could result in osseous and articular malalignment, particularly in patients with preexisting underlying metatarsus adductus.

And third, distal metatarsal osteotomies have traditionally been considered the workhorse for relatively mild to moderate transverse plane deformities. However, by both design and technique, they have a corrective anatomic limit in that they can only tolerate an approximate 50% shift of the capital fragment without compromising osseous consolidation. With the contemporary resurgence of minimally invasive surgery techniques, traditional radiographic measurements regarding severity seem inconsequential to some degree. Proponents of minimally invasive procedures cite shorter surgical times and a relatively minor surgical footprint en route to a reconstruction that is biologically, cosmetically, and functionally friendly. Advocates of minimally invasive HV correction specifically tout its ability to shift the capital fragment more aggressively because of the limited disruption of the periosteum. Consequently, greater shifts of the capital fragment approaching 90% appear more tolerable in this demographic. In a retrospective review of 217 feet, Siddiqui et al articulated this concept reporting that "the amount of translation was allowed to be as great as 90% of the metaphyseal-diaphyseal metatarsal shaft width, to maintain bony contact between the cortex of the medial proximal aspect of the capital fragment and the distal, lateral aspect of the osteotomized first metatarsal" (230). The authors reported asymptomatic malunion in 3 feet (1.4%) and delayed union of the capital fragment in 3 feet (1.4%).

The apparent broadening indication for minimally invasive distal metatarsal osteotomies and the first metatarsal-medial cuneiform arthrodesis across the spectrum of deformity severity represents a potentially interesting avenue for future investigation.

***[7] Consensus statement*: The panel reached a consensus that the statement “Procedural decision making for hallux valgus should address the specific pathoanatomy of the deformity” was *neither appropriate nor inappropriate*.**

This statement generated considerable discussion amongst the panel and perhaps highlighted the importance of surgeons and patients developing expected mutual outcomes during the consideration for and recommendation of surgical intervention. One might argue that surgeons tend to hold a relatively Cartesian view of the HV deformity in that we are generally focused on the structural findings defined by our clinical examination and radiographic evaluation. Rene Descartes (1596-1650) was a French scientist whose fundamental philosophy concluded that all of science could be explained by the concept of “matter in motion.” In other words, the body is nothing more than a series of working parts operating under the laws of physics, and pain or other pathology represents an objective and measurable deviation of this system. Ergo, if a surgeon can physically put the parts back in working positions, then the machine should return to homeostasis and function asymptomatically (35,238). Anyone working in the clinical setting knows from their experience that this is not universally the case!

Consider the historical and traditional HV evaluation defined in terms of the first intermetatarsal angle, hallux valgus angle, tibial sesamoid position, articular cartilage measurements, and others detailed in our fourth consensus statement. We utilize these measurements as tools for quantification and decision making, but they also represent a self-fulfilling prophecy concerning surgical correction. In other words, if we define HV in terms of an increased first intermetatarsal angle and subsequently perform a metatarsal osteotomy intended to decrease the first intermetatarsal angle, then we have “fixed” the deformity precisely as we have defined it.

It is doubtful, however, that any patient has ever presented to a foot and ankle surgeon’s office with a chief complaint of an “increased first intermetatarsal angle.” Instead, as previously reviewed, we currently possess an incomplete understanding of the relationship between structural deformity severity and subjective symptoms. The etiology and symptomatology are often multifactorial and extend beyond the scope of radiographic measurements. This all might represent a long-winded way of repeating the familiar maxim to “treat the patient, not the x-rays.”

So although we broadly conclude that decreasing the first intermetatarsal angle to within a normal range and realigning the first metatarsal-phalangeal joint in 3 planes with respect to the hallux and sesamoid apparatus should represent a universal end-goal of surgical intervention, it is also likely that there are multiple pathways available to achieve these results not entirely dependent on distinct pathoanatomic findings.

For specific example, although it is likely that the pathoanatomic finding of an increased first intermetatarsal angle and hallux valgus angle contributes to HV's symptomatology, a specific postoperative correctional goal has not been firmly established and has not been conclusively associated with patient satisfaction or function (70-74). Although perhaps once considered relatively aggressive, acceptable outcomes might be achieved with proximal procedures performed for relatively mild deformities and distal procedures performed for relatively severe deformities.

For a specific example, although the pathoanatomic finding of lateral capsular and muscular contraction likely contributes to the symptomatology of HV, acceptable outcomes might be achieved with or without performing the lateral release procedure (239-242).

For specific example, although the pathoanatomic finding of lateral cartilage deviation likely contributes to the symptomatology of HV, acceptable outcomes might be achieved with or without performing a specific articular realignment osteotomy (243-248).

For specific example, although it is likely that the pathoanatomic finding of decreased sagittal plane joint motion contributes to the symptomatology of HV, acceptable outcomes might be achieved by performing the first metatarsal-phalangeal arthrodesis procedure resulting in complete elimination of joint motion (249-253).

And for specific example, although it is likely that the pathoanatomic findings of equinus, or metatarsus adductus, or medial column instability, or pes valgus might contribute to the symptomatology of HV, acceptable outcomes might be achieved with or without performing specific procedures to address these findings (39,60,181,194-196,254-257).

These examples all provide indirect confirmation within an evidence-based paradigm that acceptable postoperative outcomes might be achieved through a variety of procedures, even if not explicitly addressing some of the specific pathoanatomic features identified during the preoperative evaluation. Although these all hold the potential to contribute to the symptomatology of HV, none appear to comprehensively define its presentation nor surgical outcome.

***[8] Consensus statement*: The panel reached a consensus that the statement “Hallux valgus should only be addressed with joint preserving procedures” was inappropriate.**

Decades of clinical experience and postoperative outcome-based investigations point towards the potential value of some joint destructive surgical procedures in the treatment of HV. As a prime example, the first metatarsal-phalangeal joint arthrodesis has conclusively been demonstrated to not only decrease the first intermetatarsal angle, but to decrease it within a normally accepted range even in the setting of substantial preoperative deformity (258-264). Similarly, the first metatarsal-medial cuneiform joint arthrodesis represents the procedure of choice for many foot and ankle surgeons given its predictable application across a wide range of indications (64,189,265-267). And although to some degree historical, resection arthroplasty and implant arthroplasty also continue to serve a role for many surgeons and with many patients (268-271).

What might be of more interest to readers is the potential effects of these joint destructive procedures on adjacent joints and overall foot function. Arthrodesis of the first metatarsal-medial cuneiform joint, for example, is thought to stabilize the entire medial column by giving a mechanical advantage to the peroneus longus (209,272). Avino et al reviewed pre-and postoperative radiographs of 39 feet who underwent this arthrodesis and found statistically significant changes to the medial arch through the talar-first metatarsal angle and medial cuneiform height (209). In a cadaveric study, Bierman et al evaluated the peroneus longus before and after this arthrodesis. They found significant frontal plane eversion of the medial cuneiform and dorsiflexion of the talus (272). Further, King et al found that this arthrodesis appeared to have a greater influence on load sharing distribution of forefoot pressures than did distal metatarsal procedures (201).

Few reports have looked at what effect, if any, arthrodesis of the first metatarsal-phalangeal joint has on the second metatarsal-phalangeal joint (172,273). In a retrospective review of 262 feet with first metatarsal-phalangeal joint arthrodesis, Donegan and Blume reported a 3.1% incidence of transfer metatarsalgia, a 0.8% incidence of 2nd metatarsal stress fracture, and a 1.2% incidence of second toe pain requiring arthroplasty (273). The authors found an association of metatarsalgia with patients who had a difference in metatarsal length between the first and second metatarsal of ≥3mm on postoperative radiographs. Nicholas et al evaluated 76 feet following the first metatarsal-phalangeal joint arthrodesis about the transverse plane deviation of the second toe. They observed no significant change in the second metatarsal-phalangeal joint angle. However, there was an association between the degree of change in the hallux valgus angle with the second metatarsal-phalangeal joint angle (172).

Adjacent joint arthritis represents another consideration as a potential complication following an arthrodesis procedure. Coughlin et al reviewed 21 first metatarsal-phalangeal joint arthrodeses for idiopathic hallux valgus, and after a mean of 8.2 years, 33% developed mild hallux interphalangeal joint arthritis (274).

Finally, delayed union and nonunion might also represent a relatively unique complication to joint destructive procedures. However, the rate of symptomatic nonunions for both the first metatarsal-phalangeal and first metatarsal-medial cuneiform arthrodeses are relatively low, particularly when considering that nonarthrodesis metatarsal osteotomy procedures have a wide range of clinical recurrence rates and their own unique potential complication profile (275,276). The panel reached a consensus that joint destructive procedures for HV can be practical and relatively safe.

***[9] Consensus statement*: The panel reached a consensus that the statement "There is no role for biologic augmentation in the surgical correction of hallux valgus" was <u>neither appropriate nor inappropriate</u>.**

Although there are many contemporary options for biologic augmentation in first ray surgery, specific indications and the direct effects are unclear. Anecdotal reports are certainly available detailing the use of various adjuvants in primary procedures, but any conclusions drawn from these are inherently limited due to a lack of controlled comparison. This includes extra-articular osteotomies but has been predominantly described with the first metatarsal-phalangeal and first metatarsal-medial cuneiform arthrodeses. Bone marrow aspirate concentrate, for example, has demonstrated good reported results with the latter (277-279). However, union rates are likely effectively equivalent to union rates without augmentation for most patients (118,280-284). Augmentation might have more utility and indication for revisional procedures in patients with certain risk factors and to help maintain length during arthrodeses (280-282,285-287). Randomized comparative trials, comparative effectiveness methodologies, and cost-benefit analyses would likely be of value to improve decision-making with respect to this topic.

***[10] Consensus statement*: The panel reached a consensus that the statement "The outcome of hallux valgus surgical correction is independent of procedure selection" was <u>appropriate</u>.**

Given the evident diversity of procedures available for correction of the HV deformity, it stands to reason that there is not a singular procedure associated with its cure. In one light, this conclusion might be considered encouraging in that foot and ankle surgeons are not restrained to a single procedure or limited group of operations, but instead have some choice to utilize their personal experience and individual surgical skills in deciding what might be best for a particular patient. In another light, however, this conclusion might be discouraging in that clear, universally accepted guidelines are unlikely to be established. A broad view of the literature indicates that many procedures might be utilized to achieve a positive outcome and that these same procedures appear to share a similar risk profile for a negative result.

Certainly, one way to view a negative outcome is in terms of deformity recurrence. Rates of recurrence for HV reported in the literature vary widely, from as low as 2.7% to as high as 75.0% (276,288,289)! Some of this variation is likely explained by a lack of clear definitions for deformity recurrence. As an example, Shibuya et al recently published a logistic regression of variables associated with HV recurrence utilizing the definition of merely a 3 degree loss of correction in the hallux valgus angle (290). Others have used more aggressive definitions, including a return to abnormal ranges of radiographic parameters. Regardless of a specific definition, some trends of the association have emerged from the literature concerning HV recurrence, including but not limited to increased preoperative deformity, persistent first metatarsal head lateral cartilage malalignment, relatively long first metatarsal length, and postoperative sesamoid malalignment (155,165,288,290-292).

Undercorrection in the form of persistent tibial sesamoid malposition has historically been a particular concern with HV deformity's recurrence the following repair. Shibuya et al retrospectively evaluated relapse of HV, and after adjusting for covariates, the single significant factor was tibial sesamoid position. In fact, the recurrence rate was greater than 50% with a tibial sesamoid position of greater than 4 on a 7-point scale (292). Okuda et al reached a similar conclusion (293). Those patients with a displaced tibial sesamoid at initial follow-up demonstrated statistically significant elevation of first intermetatarsal and hallux valgus angles compared to patients that preserved a normal sesamoid position. This defined a degradation of correction over time correlating to the sesamoid position. Hatch et al suggest that displacement of the medial sesamoid is related to pronation of the first metatarsal with standard anterior-posterior radiographs of the foot. To achieve a congruent metatarsal-phalangeal joint and limit the likelihood of recurrence, they argued a supinatory rotation of the first metatarsal must be performed with the appreciated restoration of the sesamoid position (62,64).

A second clear way to define adverse outcomes is utilizing functional outcome measures. In 2005, Thordarson et al investigated functional outcomes using validated questionnaires in a 2-year prospective study. The authors identified that regardless of mild to moderate to severe deformity, statistically significant improvement scores were achieved. Further, the amount of preoperative deformity, postoperative residual deformity, or amount of correction required did not significantly impact scores. The authors concluded that the degree of deformity, amount of correction, and type of procedure had no bearing on patient-centered outcomes (73). Matthews et al also looked at preoperative radiographic parameters and patient-centered outcomes in hallux valgus surgery. Using the Foot and Ankle Outcomes Score, no radiographic parameter highly correlated with patient outcome. They concluded that the ongoing emphasis of radiographic parameters preoperatively and postoperatively should be questioned (70,71).

Given the heterogeneity present with respect to procedure selection and utilized outcome measures, it is difficult to draw any definitive conclusions based on the literature with respect to the effect of a given procedure on the outcome. The panel agreed that both positive and negative outcomes might be achieved through a variety of means.

***[11] Consensus statement*: The panel was <u>unable to reach a consensus</u> on the statement "The post-operative course for hallux valgus correction should involve a period of non-weight bearing immobilization."**

The recommended postoperative HV protocols found in the literature range widely from immediate weightbearing up to several months of non-weightbearing cast immobilization. The multiplicity of procedures in numerous anatomic locations, variances in the inherent stabilities of differing osteotomies, and vast differences in available fixation constructs likely precludes universal consensus on this topic. However, regardless of procedure and fixation choice, it is vital for foot and ankle surgeons to appreciate the underlying science and mechanobiology of soft tissue and bone healing for any procedure that they perform. And generally speaking, it might be likely that postoperative protocols have remained dogmatically conservative despite contemporary surgical techniques and advancements.

Unfortunately, very few studies are available directly evaluating lower extremity postoperative weightbearing protocols to confirm or refute the value of early loading and dynamization (294-296). Most information on the topic comes indirectly from benchtop science interpretation, retrospective case series of a single protocol, and clinical experience. It stands to reason that potential complications of prolonged immobilization such as the risk of disuse atrophy, functional impairment, and vascular impedance processes including venous thrombosis would be mitigated with early mobilization, but specific data is not available to definitively support this supposition.

In terms of science, Ghimire et al found that early loading promotes increased mesenchymal stem cells in the endosteal zone with increased chondrogenic factors in the cortical and periosteal callus during early fracture repair (297). Ganadhiepan et al describe a synergistic effect of early loading, cellular mediated promotion of generated growth factors, and cellular response to enhance secondary bone healing (298). One might also question the value of primary bone healing, which demands absolute stability of osteotomies, fractures, and arthrodesis sites. It has been suggested that optimal bone healing might occur in the presence of both primary and secondary responses. New internal fixation devices are able to achieve the engineering benefits of external fixation by stabilizing bone entirely along its segment and not just at points of fixation. Locking plates, for example, allow for a physiologic response while maintaining alignment. Many devices also provide options for compression that might allow for primary bone healing within a locked construct.

A number of retrospective case series have found acceptable outcomes with early weightbearing protocols in terms of maintained alignment, implant stability, bone healing, and lack of deformity recurrence with a variety of osteotomies and with a variety of fixation constructs. These include everything from compression screws to locking plates for distal, midshaft, and proximal metatarsal osteotomies (283,285,299-305). Similar findings have also even been observed for both the first metatarsal-phalangeal joint and first metatarsal-medial cuneiform arthrodeses (304–307).

The heterogeneity of these studies in terms of specific procedures and fixation constructs might be considered a limitation of the literature. Still, it might also give foot and ankle surgeons confidence that early weightbearing protocols are not necessarily reliant on a specific product. One conclusion from this variation might be that acceptable and effective outcomes can be achieved through a variety of means. Although the science of dynamization continues to evolve, clinical evidence and experience appear to suggest its value to promote healing without substantial complication when basic core principles of stability are observed.

***[12] Consensus statement*: The panel reached a consensus that the statement "Physical medicine and rehabilitation interventions should be considered for patients undergoing hallux valgus surgical treatment" was <u>appropriate</u>.**

Several studies have seemingly demonstrated a potential benefit to the use of postoperative physical therapy and rehabilitation interventions on outcomes following HV surgery. These have been shown to increase metatarsal-phalangeal joint range of motion, decrease stiffness, improve sensitivity/nerve dysesthesia, assist with scarring and persistent swelling, normalize gait, allow for an early return to shoegear, and improve clinical outcome measures (308-311).

Despite appropriate surgical correction with the restoration of the anatomic alignment of the first metatarsal-phalangeal joint, limited range of motion, decreased function, and abnormal peak pressures under the first ray might persist (312,313). Schuh et al prospectively followed 30 patients undergoing either Austin or Scarf-type metatarsal osteotomies. They implemented a standardized physical therapy protocol involving an edema reduction stocking, elevation, lymphatic drainage, muscle pump activation, cryotherapy, manual manipulation, oscillating traction, and mobilization of the midfoot and rearfoot joints with a concentric strengthening of the hallux flexor and extensor tendons (309,310). This resulted in improved pedobarographic measurements, increased passive range of motion, and improved American Orthopedic Foot and Ankle Society (AOFAS) scores. Further, Connor and Berk directly compared continuous passive motion with physical therapy alone. They found a more extensive range of motion in the continuous passive motion group with earlier return to shoegear (311).

With that said, conclusions are drawn from these, and other investigations are inherently limited secondary to the lack of a control group. There is, therefore, a risk of confirmation bias where it is unclear if the demonstrated patient improvement is a direct result of the implemented protocols or simply the result of time and the expected resolution of normal bone and soft tissue healing processes. Further, it remains unclear which specific outcomes and modalities carry the greatest effect. The range of motion of the first metatarsal-phalangeal joint is likely the most reported outcome, but questions remain with respect to differences between dorsiflexion, plantarflexion, and a total range of motion, as well as the association between a range of motion and functional outcome (314). Plantarflexion grip strength might represent an exciting avenue for future investigation with respect to this topic.

While formal physical therapy is likely not necessary for all patients, the implementation of some of these rehabilitation interventions might serve as a valuable adjunct to postoperative recovery from HV surgery with minimal associated risk.

***[13] Consensus statement*: The panel reached a consensus that the statement "The postoperative evaluation of hallux valgus should include an assessment of functional outcome measures" was <u>neither appropriate nor inappropriate</u>.**

Although the specifics might not yet be clear, it is evident that many US health care centers, hospitals, and third-party payers are working towards value-based and outcome-based reimbursement strategies.

This represents a potential challenge concerning the assessment of both short- and long-term outcomes following HV surgical correction secondary to a lack of uniformity in procedure selection, postoperative protocols, and clinical outcome measures (315).

Schrier and colleagues examined multiple functional outcomes commonly used to evaluate HV and determined that the Manchester-Oxford Foot Questionnaire (MOXFQ) might be the most appropriate measurement tool (316). They also concluded that the visual analog scale (VAS) best-assessed pain and that the Short Form-36 (SF-36) best assessed general health. Dawson et al also found the MOXFQ score was highly responsive for HV surgery (317). In contrast, others have advocated for other clinical outcomes, including but not limited to the Patient-Reported Outcomes Measurement Information System, Foot and Ankle Ability Measure, Foot Function Index, and ACFAS Scoring Scales (74,318,319).

The AOFAS score (72,73,245,246,317,320-329) and VAS (245,246, 325,326,329-332) are likely the most commonly reported outcome measurements, but most investigations utilizing these tools demonstrate statistically significant results regardless of the specific procedure or fixation construct, limiting its specificity (276,333-341). Further, the AOFAS score has been shown to be an relatively unreliable outcome measure (324,325,346,347).

This is likely an interesting potential area for future investigation as not all short- and long-term outcomes are positive following HV surgical correction. Chong et al found that 25.9% of patients were dissatisfied at 5 years postoperatively (342). Chen et al found that up to 31% of patients still had pain at 6 months postprocedure, although this improved for up to 2 years (344). In another study with 2 years follow-up, Nilsdotter et al observed that surgical treatment of HV reduced pain and improved function, but these improvements were greatest within the first 6 months postoperatively (343). An interesting subanalysis demonstrated that higher preoperative VAS scores were associated with residual pain after 6 months. And one study even found that prolonged preoperative wait times had a negative effect on patient-reported outcomes (345). It was suggested that in patients with symptomatic HV, expeditious surgical treatment might decrease the rate of poor results!

We did not identify any investigation specific to outcomes-based reimbursement and HV. Still, We did encounter several review articles that have examined this topic as it relates to orthopedics and other surgery-based specialties (348-351). Walijee and Nellans reported that with respect to extremity orthopedic surgery, this might be the best thought of in terms of safety, outcomes, satisfaction, and cost (349). Perhaps the most modifiable in terms of individual surgeons and their practices are patient satisfaction and outcomes measurement. The strongest predictor of patient satisfaction has been identified as physician-patient communication, but other important factors include the number of time physicians spend with patients, patient waiting time for physicians, and the physician's ability to acknowledge risk and uncertainty with respect to patient care (349,351-353).

Andrawis et al criticized that orthopedic specialties lag behind other specialties with respect to the evaluation of functional outcomes because of a lack of accepted definitions, undefined indications for surgical intervention, and having too many outcome measures all evaluating similar things (350). This likely represents an area where our national organizations might potentially work together towards standardization and physician education on a topic likely to affect practice management in the coming decades.

Executive Statement

The following represents a clinical consensus statement sponsored by the American College of Foot and Ankle Surgeons® on the topic of the adult hallux valgus deformity. An 8-member panel undertook a modified Delphi method in an attempt to develop consensus on a series of 13 statements utilizing not only the best available evidence but also a degree of clinical experience and common sense.

The panel reached a consensus that the following statements were "appropriate":

- The hallux valgus deformity should be considered a chronic, progressive, and degenerative condition.
- The juvenile hallux valgus deformity should be evaluated and managed differently than the adult hallux valgus deformity.
- Effective assessment of the hallux valgus deformity requires radiographic evaluation.
- The outcome of hallux valgus surgical correction is independent of procedure selection.
- Physical medicine and rehabilitation interventions should be implemented for patients undergoing hallux valgus surgical correction.
- The panel reached a consensus that the following statement was "inappropriate":
- Hallux valgus should only be addressed surgically with joint preserving procedures.
- The panel reached a consensus that the following statements were "neither appropriate nor inappropriate":
- Procedural decision-making for hallux valgus should address the specific pathoanatomy of the deformity.
- There is no role for biologic augmentation in the surgical correction of hallux valgus.
- Postoperative evaluation of hallux valgus should include an assessment of functional outcome measures.
- The panel was unable to reach a consensus on the following statements:
- The natural course of the hallux valgus deformity might be interrupted with nonsurgical interventions.
- The presence of first ray hypermobility directly affects the prognosis of the hallux valgus deformity and intervention outcome.
- Procedural selection for hallux valgus should be based on the severity of the deformity.
- The postoperative course for hallux valgus correction should involve a period of non-weightbearing immobilization.

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