ABSTRACT
Glenohumeral joint instability is extremely common yet the definition and classification of instability remains unclear. In order to find the best ways to treat instability, the condition must be clearly defined and classified. This is particularly important so that treatment studies can be compared or combined, which can only be done if the patient population under study is the same. The purpose of this paper was to review the problems with historical methods of defining and classifying instability and to introduce the FEDS system of classifying instability, which was developed to have content validity and found to have high interobserver and intraobserver agreement.

DEFINITIONS OF INSTABILITY
Before a disorder is classified, it must be defined very clearly. For example, does a pitcher with a dead-arm feeling when throwing have ‘instability’? Does a patient with a posterior labral tear with pain, but not sensation of the joint slipping or a feeling of looseness—have ‘instability’? Historically, many experts have offered different definitions for this common malady. In 1992, many of the North American shoulder experts met in Vail, Colorado, to help define and determine the state of the art for many shoulder conditions.6 Interestingly, these experts offered a variety of definitions for glenohumeral joint instability (figure 1). In light of these different perspectives, how can a consensus be reached?

Table 1 Features of Neer and Foster’s multidirectional instability population

<table>
<thead>
<tr>
<th>Feature</th>
<th>No with symptom (N=40) for entire population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solitary episode</td>
<td>0</td>
</tr>
<tr>
<td>More than one episode</td>
<td>40</td>
</tr>
<tr>
<td>Traumatic origin</td>
<td>29</td>
</tr>
<tr>
<td>Atraumatic origin</td>
<td>7</td>
</tr>
<tr>
<td>Direction anterior</td>
<td>29</td>
</tr>
<tr>
<td>Direction inferior</td>
<td>40</td>
</tr>
<tr>
<td>Direction posterior</td>
<td>29</td>
</tr>
<tr>
<td>Subluxation event</td>
<td>38</td>
</tr>
<tr>
<td>Dislocation event</td>
<td>2</td>
</tr>
<tr>
<td>Hyperlaxity</td>
<td>17</td>
</tr>
<tr>
<td>Presence of Bankart lesion</td>
<td>5</td>
</tr>
</tbody>
</table>

The frequency with which different features of instability are found in Neer and Foster’s classic 1980 paper on multidirectional instability—all had in common the same inferior capsular shift operation.

Glenohumeral joint instability is extremely common. With regard to primary anterior shoulder dislocations, the incidence is between 8.2 and 25.9 per 100 000 person-years, with an estimated prevalence of 1.7%.1–3 Whereas these estimates seem high, they actually underestimate the true nature of instability, as they do not include subluxation events or instability in other directions. Despite the widespread nature of glenohumeral joint instability, the definition of this condition is not clear and there is no consensus on how this disorder should be classified.

Historically, the medical literature regarding instability has a number of flaws. First, most studies in the literature are procedure-based and not condition-based. An example is the landmark 1980 paper by Neer and Foster7 on ‘multidirectional’ instability. In that study, the authors included patients with different features of instability—yet the patients had in common the same operation, an inferior capsular shift (table 1). When a paper is procedure based it may include a heterogenic population that will produce confusion both regarding the definition of instability and whether the procedure described would be helpful for a particular patient in your office. Instead, papers should be condition-based, in which a population of patients with a specific, well-defined constellation of features is collected and two treatments are compared.

As a result of these historical problems, we do not have clear definitions for glenohumeral joint instability in the literature and papers tend to use a pot-pouri of descriptive terms (voluntary, traumatic unidirectional Bankart lesion treated with surgery, unidirectional, multidirectional, bidirectional, traumatic, atraumatic, microtraumatic, etc). This problem leads to heterogeneity in the literature making comparisons of different treatments difficult and meta-analyses nearly impossible.

This confusion has been highlighted by McFarland et al,5 who compared four different classification systems for patients with instability and found great variation, particularly with regard to multidirectional instability, leading the editors of the Journal of Bone and Joint Surgery to opine that the article by McFarland et al was a “…provocative call to action”, and “Until the criteria for diagnosis are clearly defined, investigators will be unable to contribute in a compelling way to understand the condition since they cannot know whether studies are comparing ‘apples and oranges’.5 This confusion in how instability is defined was also demonstrated by Chahal et al,7 who found that physicians had poor agreement when asked to classify clinical scenarios of glenohumeral joint instability. These works provide evidence that we need better ways of defining and classifying glenohumeral joint instability.
patients without symptoms, and that some patients can sublux their shoulders without symptoms. Therefore, these two elements must be found together to define instability—patients must have discomfort and a feeling of looseness, slipping, or the shoulder ‘going out’ to meet the definition of instability.

CLASSIFICATION OF INSTABILITY

Once the condition is clearly defined, its features can be studied and categorized into meaningful classification systems. The classification of instability would help us in many ways. Instability classification systems should alert us to specific anatomical features we can expect to see with a specific type of instability, they should give us information regarding the natural history and prognosis of a type of instability, and they ultimately should offer recommendations regarding treatment.

A variety of classification systems have been proposed for shoulder instability. The authors of these papers developed their instability classification system after careful thought, yet the variation is remarkable. Although there is some agreement regarding the features that are included (figure 2), there is also a great amount of discordance, and different features are included in different classification systems. Interestingly, none of these systems has undergone reliability testing or validation. It is not surprising that there is no standard method to classify instability and that studies have demonstrated that patients may be given different diagnoses when different methods of classifying instability are used, and that physicians have poor agreement in how they describe the same patient.

THE FEDS SYSTEM FOR CLASSIFYING GLENOHUMERAL JOINT INSTABILITY

At our institution we undertook a systematic approach to develop a method to classify shoulder instability—the FEDS classification. We performed a systematic review of the literature to identify proposed classification systems, and determined which features of instability were used most commonly (figure 2). Of all of the features of instability used by the
were the most commonly used features (from Allen,9 Cole and
are used is presented. Aetiology, direction, severity and frequency
of glenohumeral instability. The frequency with which different features
classification systems of glenohumeral joint instability. A systematic
review identified 18 different proposed classification systems of
authors, four were seen in more than 50% of the proposed clas-
Figure 2 Different criteria used by different authors in proposed
classification systems of glenohumeral joint instability. A systematic
review identified 18 different proposed classification systems of
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were the most commonly used features (from Allen,9 Cole and
Waren,10 Cofield and Irving,11 Galinat and Warren 1990,12 Gerber and
Nyffeler,13 Joseph et al,14 Lewis et al15 Maruyama et al,16 Nebelung,17
Ozkan et al,18 Pollock and Flatow,19 Protzman,20 Rockwood,21
Schneeberger and Gerber,22 Silliman and Hawkins,23 Thomas and
Matsen,24 Wirth and Rockwood25).

This information then led to the development of the FEDS
classification for instability. Fortunately, the features of insta-
bility deemed most important (frequency, aetiology, direc-
tion and severity) could be obtained by history and physical
examination. After a meeting of experts, the FEDS system was
developed (figure 3).

**Frequency**
Frequency is an indirect measure of the severity of pathology,
and is helpful in determining the approach to the patient. We
purposefully chose the number of episodes over the course of
1 year due to the seasonal nature of sports. In considering fre-
cuency, the FEDS system has three levels. Solitary = one epi-
sode. It is likely that many patients with one episode will be
managed non-operatively. Occasional = two to five episodes.
The patient with a few episodes may have a very different
type of instability to the patient with more than five episodes
per year, which would be described as frequent.

**Aetiology**
Most classification systems consider aetiology to be important
and argue that patients with a history of trauma are managed
differently to those without. While repetitive loading leading
to symptoms has been described in the past as ‘microtraumatic’
or ‘subtle’ instability, we purposefully chose not to include this
as a separate class (see below). Most athletes with shoulder
trouble do not have instability by the definition above (a feel-
ing that the shoulder is slipping, loose or going out)—rather
they present with pain. As such, they would not be defined
as having glenohumeral instability. Some athletes could have
a feeling that their shoulder is loose without a specific injury.
This group would fall under the atraumatic group.

**Direction**
Nearly every classification system includes the direction of
the instability. In the FEDS classification, we rely on the his-
tory and the patient’s perception of the instability. Patients
may be able to tell you the direction of their instability, or
may be able to tell you which position of the arm will repro-
duce their symptoms (hand behind the head for anterior, car-
ying a briefcase for inferior, pushing on something in front
of the body for posterior). If the patient cannot tell the phy-
sician, the effect of provocative tests (translation anterior,
inferior, posterior or apprehension test, sulcus sign, jerk test)
will help determine the direction. We purposefully decided
to eliminate the concept of ‘multidirectional instability’, and
instead focused on the primary direction of symptoms when
describing the direction of the instability (see below).

**Severity**
The severity of the instability is another criterion that comes
from the history and is another indirect measure of the sever-
ity of the pathology. Patients can have subluxations or dis-
locations. It may be difficult to distinguish between these;
however, in general subluxations will autoreduce, whereas dis-
locations will not. Therefore, the question for the patient: “Did
you need, or have you ever needed help getting your shoulder
back in?” is a yes or no question. It serves as a differentiating
point, for the severity of the injury may help us gain some
insight into the pathology.

**TESTING OF THE FEDS SYSTEM**
The FEDS classification system was assessed for interobser-
and intraobserver agreement in a population of 49 patients with
instability defined by answering yes to the question: “Do you
feel like your shoulder is slipping, unstable, loose, or falling
out of place?” These patients completed a survey, as did one
of six sports medicine fellowship trained specialists. Patients
returned after a minimum of 2 weeks and completed the sur-
vey again, as did the original treating physician and a second
physician. Intraobserver agreement for the FEDS system was
84–97% with k ranging from 0.69 (substantial) to 0.87 (almost
perfect). Interobserver agreement was 82–90%, with k ranging
from 0.44 (moderate) to 0.76 (substantial).26

**DISCUSSION**
The FEDS classification system is highly dependent upon the
history and therefore the patient’s perception of the disorder.
Of all of the possible criteria for classifying instability, fre-
cuency, aetiology, severity and even direction can be obtained
by questioning patients. Other criteria used historically to clas-
sify glenohumeral joint instability are physician derived, and
include findings of examination under anaesthesia, examina-
tion and physician judgement as to the presence of a volitional
nature to the instability, examination and physician judge-
ment as to the presence of hyperlaxity, radiographic findings
and pathological findings from surgery.

Figure 2 Different criteria used by different authors in proposed
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Matsen,24 Wirth and Rockwood25).
In general, physician-derived criteria are less valuable, as the findings during examination are highly dependent upon the skill and experience of the examiner. As such, examination findings are highly subjective and interrater/intrarater reliability is poor. In addition, radiographic findings are dependent upon the presence of imaging tools, which may not be available in some parts of the world, and are likely to change as technology improves with time. Using pathological findings from surgery as a criterion is not ideal as it precludes making a diagnosis until surgery is performed. This would prevent the assignment of patients into groups for trials of non-operative therapy.

Interestingly, provocative physical examination tests designed to reproduce the patient’s symptoms for instability, including the anterior apprehension test, the sulcus sign and load and shift tests, have been found to be sensitive, specific, and have high predictive values, with reasonable interexaminer reliability. Therefore, these features of the evaluation of the patient with instability can be useful. In the FEDS system, they are used in a comparative fashion to identify the primary direction of the patient’s instability.

The problem with ‘multidirectional’ instability

With regard to the direction of the instability, we intentionally focused on determining the primary direction of the instability and did not use the ‘multidirectional’ concept. We did this for the following reasons: (1) The term ‘multidirectional instability’ has been used by different authors to mean different things, and as a result the literature is very confusing. (2) Neer and Foster in 1980 originally described the condition of multidirectional instability as having the sine qua non-feature of an increased sulcus sign, which would equate to having primary inferior symptoms in the proposed classification. (3) It could be argued that every form of shoulder instability could have excessive translations in multiple planes, as biomechanical and clinical research suggests that the capsule of the glenohumeral joint behaves as a circle and that injuries are unlikely to produce damage in only one part of the capsule. As a result, the concept of ‘multidirectional’ instability is flawed and it is unlikely to have a clear agreed-upon definition among clinicians—as such we argue for its elimination, substituting the primary direction to describe the direction of instability instead.

The problem with ‘subtle instability’

Rowe described the ‘dead arm’ syndrome in 1987. While some patients described a sense of shoulder looseness, many did not. Rowe considered all to have instability and performed instability surgery as a treatment. The problem is, as Rowe noted, pain is not specific for instability. Many of Rowe’s patients had “signs and symptoms of bursitis, biceps tendonitis, nerve impingement, cervical spine referred pain and thoracic outlet syndrome.” As such, it is not clear if these patients truly had instability.

Jobe et al in 1989 used ‘subtle instability’ to describe the athlete with shoulder pain. In this condition the patient may not have symptoms of the shoulder subluxing or dislocating, yet excessive laxity in the capsule presumably leads to other
pathologies and other symptoms such as pain. Jobe used an instability operation to treat these patients and reported good success.

We would argue that the term ‘subtle instability’ is a poor choice, and that perhaps ‘excessive laxity’ would have been better. Again we refer to the concept that symptoms of instability are required for the diagnosis of instability. As such, patients with the constellation of findings that are seen in the athlete with the painful shoulder do not belong in the diagnosis of instability unless the athlete has symptoms of the arm having episodes of being loose. We would argue that as our understanding of the pathomechanics of the thrower’s shoulder develops, a unique system for classifying different grades of pathology in the painful shoulder of the athlete will evolve.

The problems with ‘voluntary’ instability

In 1973, Rowe et al. published a series of patients with ‘voluntary instability’. After performing psychological testing on these patients, Rowe brought attention to the fact that patients with secondary gain age or psychiatric pathology did poorly with treatment. Those with voluntary instability who tested with secondary gain age or psychiatric pathology did poorly.

Any classification system must meet the following criteria:

1. It must be simple and easy to use;
2. It must accurately describe different types of instability with exclusion so that there is no ambiguity with assignment of patients;
3. It must have high reliability;
4. It should reflect the patient’s perception of the disorder so that the integrity of outcome measures can be preserved;
5. It should be useful in predicting the natural history and possible treatment options.

It is clear that current methods of classifying glenohumeral joint instability have led to much confusion in the literature. These definitions are confused in the literature, including ‘habitual instability’, which has erroneously included voluntary and involuntary by some authors, and ‘involuntary positional instability’. These definitions are confused in the literature and it is difficult to distinguish which patients may have psychological issues.

As a result, we do not believe the term ‘voluntary instability’ is particularly helpful in a classification of glenohumeral instability. Instead, we would consider using this concept as a qualifier for the descriptions above, and change the terminology to ‘demonstrable instability’ to describe patients who can demonstrate their instability but have no psychological or secondary gain issues, and ‘volitional instability’ for those patients who have the desire for their shoulder to sublux or dislocate. We would also recommend that researchers consider psychological testing on these patients to validate their classification of patients when studying such patients.

CONCLUSION

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3. It must have high reliability;
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5. It should be useful in predicting the natural history and possible treatment options.

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Shoulder injuries in athletes

None.
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A new classification system for shoulder instability

John E Kuhn

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