

Prospective Evaluation of Forelimb Flexion Tests in Practice: Clinical Response, Radiographic Correlations, and Predictive Value for Future Lameness

David W. Ramey, DVM

Many otherwise normal horses demonstrate a positive response to forelimb flexion tests. The response varies directly with the pressure applied to the limb. A positive response to flexion does not correlate with future lameness or lower limb radiographic abnormalities. Reliance on this test to diagnose subclinical lameness or predict future problems seems unwise. Author's address: P.O. Box 5231, Glendale, CA 91221. © 1997 AAEP.

1. Introduction

Forelimb flexion tests were described in the Swedish veterinary literature as early as 1923. They appear to have become an integral part of the evaluation of the lame horse. In addition, forelimb flexion tests appear to be routinely included in prepurchase evaluations of the horse.

In a forelimb flexion test, various joints and soft-tissue structures of the lower limb (from the carpus distally) are held in flexion for a short period of time. Afterward, the horse is immediately trotted off and observed for signs of lameness.

There is no consensus in the information available to the practitioner as to the optimum force and duration of forelimb flexion tests. Published ranges of the optimum duration of the test vary from 30 s to 3 min. Devices used to measure the force applied to the limb by flexion have been designed in Sweden and Belgium; the recommended force for flexion

tests conducted by flexing the fetlock joint, holding the toe, has been reported at 140 and 100 N, respectively (10 N is approximately equal to 1 kg of force). However, it appears that calibrated devices to measure the force applied during fetlock flexion are not widely used in practice.

This study attempts to answer several questions pertaining to forelimb flexion tests in the normal working horse that is free of observed lameness. First, the study examines whether or not the amount of force applied to the limb affects the response to the flexion test. Second, the study reports the number of horses (and limbs) that demonstrated a positive response to forelimb flexion with mild and firm pressure. Third, the study correlates radiographic changes in the proximal and distal interphalangeal and metacarpophalangeal joints with response to flexion. Finally, the study correlates the response to forelimb flexion with the occurrence of lameness over a 60-day observation period.

NOTES

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2. Materials and Methods

Fifty horses (100 legs) of various breeds, ages, sex, and occupation were examined for this study. Breeds, ages, sex, and occupations of the horses examined included a wide variety of pleasure and performance horses and were a representative sampling of the horses treated in the author's practice.

A lameness history of all horses was obtained. All horses were examined on hard ground at the trot in hand prior to inclusion in the study and were palpated for abnormal swellings or areas of soreness. Any potential candidate for the study showing signs of clinical lameness or demonstrating gross physical abnormalities was rejected. All horses were re-evaluated at the trot in hand on hard ground and the lameness history was updated 60 days after the initial evaluation. If an individual horse incurred some lameness in the 60-day period following the initial examination, this was correlated with clinical, flexion test, and radiographic findings.

Two separate flexion tests were performed on each forelimb. In each test, the limb was supported in the air by the toe for a period of 60 s. No pressure was applied to the back of the fetlock joint or the tendinous structures. No effort was made to hold the interphalangeal joints straight, as has been described. The carpus was held with approximately 90° of flexion, and a conscious effort was made not to apply excessive pressure to this area.

In the first flexion test, the limb was held with a mild amount of pressure (a normal flexion test). The force applied in the normal flexion tests was not calibrated; however, this amount of pressure was only slightly more than the flexion that is normally obtained by the weight of the limb pulling toward the ground when the limb is suspended by the toe. No horse resented manipulation of the limb in this fashion. In the second flexion test, maximum firm flexion of the limb was attempted (firm flexion test). Many horses resented or appeared anxious as a result of this test. Both flexion tests were held for 60 s, at which time the horse being examined was immediately trotted off and the degree and duration (distance) of the lameness response was noted. In an attempt to achieve some sort of standardization of the tests, all flexion tests and examinations were performed by the author.

A positive response to forelimb flexion, characterized by the horse limping, was graded on a previously reported five-point scale (see Table 1). Although the scale is not intended to be applied to manipulative procedures, it was useful in assessing the degree of initial lameness after limb flexion. A score of 0/5 was given to horses with no observed lameness after flexion, and a 5/5 meant that the horse became nonweight bearing after the test.

Lateral and D-P radiographs of each foot–pastern–fetlock area were obtained and evaluated. The findings were tabulated and correlated with the response to flexion.

Table 1. AAEP Guidelines for the Definition and Classification of Lameness

Definition:	Lameness is a deviation from the normal gait or posture due to pain or mechanical dysfunction.
Classification:	
Grade 1:	Difficult to observe; not consistently apparent regardless of circumstances.
Grade 2:	Difficult to observe at a walk or in trotting a straight line; consistently apparent under certain circumstances (i.e., weight carrying, circling, inclines, hard surface, etc.).
Grade 3:	Consistently observable at a trot under all circumstances.
Grade 4:	Obvious lameness: marked nodding, hitching, or shortened stride.
Grade 5:	Minimal weight bearing in motion or at rest; inability to move.

3. Results

Twenty of 50 horses (40%) demonstrated some positive response to normal limb flexion. In two horses, the positive response was bilateral; 18 of the horses demonstrated a positive response in one leg only. Thus, 22 of the 100 limbs flexed (22%) demonstrated some positive response to normal limb flexion. In ten of the 50 horses (20%), a positive response to limb flexion was demonstrated for only a few steps. However, ten of the 50 horses (20%) demonstrated a positive response to limb flexion for a duration of 50 ft (15.24 m) or greater. The greatest degree of observed lameness response to normal limb flexion was 3/5.

Forty-nine of the 50 horses (98%) demonstrated a positive response to firm limb flexion. Two horses were positive to flexion in one limb only; another horse showed no positive response to firm flexion on either limb. Thus, 96 of the 100 limbs flexed (96%) demonstrated a positive response to firm limb flexion. In four horses, the horse was nonweight bearing after the firm flexion test (5/5 lameness). Thirty-five of the 50 horses (70%) demonstrated a response of at least 4/5 for a minimum of 50 ft after firm limb flexion.

Seven of the 50 horses developed lameness problems in the 60-day period after their initial forelimb flexion tests. Five of these horses developed hind-limb lameness: the causes of the lameness in the forelimbs of the two other horses were thrush and recent shoeing. Thus, any positive response to forelimb flexion tests was not associated with any subclinical lameness in the areas typically stressed by the test that appeared within the 60-day period following the initial evaluation.

Twenty-four of the 50 horses (48%) had identifiable radiographic abnormalities in one or both forelimbs (Table 2). However, only ten of these horses with radiographic abnormalities demonstrated a posi-

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Table 2. Radiographic Changes and Correlation to Flexion Test Response

Radiographic Abnormality	Number of Limbs with Abnormality (Per 100 Limbs)	Positive Flexion Test (Per Abnormality)
Remodeling dorsal P2	18	4
Remodeling dorsal P1	10	5
Extensor process spur	2	0
Enthesophyte posterior dorsal P2	3	0
Enthesophyte middorsal P2	6	2
Enthesophyte midposterior P1	1	0
Enthesophyte lateral P1	1	1
Osteochondral proximal dorsal fragment P1	1	0
Osteochondral fragment, extensor process	3	0
Osteochondral fragment, proximal palmar P1	2	0

tive response to normal flexion in one or more limbs. Furthermore, in two of these horses, the radiographic abnormality existed in a limb that did not have a positive response to flexion, and the limb that responded positively to flexion had no radiographic abnormalities. The 20 horses that responded positively to normal limb flexion had a 50:50 chance of having radiographic abnormalities. This was not significantly different from the likelihood of any horse in the study having radiographic abnormalities.

It appeared that an increasing age increased the chance of a positive response to forelimb flexion. Seven of the 20 horses (35%) demonstrating a positive response to normal flexion were 10 years of age or less; 13 of the 20 horses (65%) demonstrating a positive response to normal flexion were greater than 10 years of age. The age of the horses in the study ranged from 3 to 15 years. The median age of the horses was 10 years. There was no identifiable risk for positive response to normal forelimb flexion based on breed, sex, or occupation of the horses in the study.

4. Discussion

Forelimb flexion tests appear to be commonly used for both diagnosing a lameness and conducting pre-purchase evaluations. This study suggests that reliance on forelimb flexion tests for a diagnosis of impending lameness or to detect subclinical problems that may adversely affect a purchase decision may not be warranted. Furthermore, a positive response to forelimb flexion does not correlate well with radiographic abnormalities of the lower limbs.

A positive response to forelimb flexion tests has been described in the literature as being a feature of lame horses, with pain coming from the navicular bone, the caudal foot, the pastern, the fetlock joint, the sesamoid bones, the annular ligament, osseous cysts of the distal third metacarpal bone, the superfi-

cial and deep flexor tendons, the tendon sheath, the suspensory ligament, and the carpus. Obviously, a positive response to this test cannot be considered pathognomonic for any particular condition of the horse that causes lameness. Frequently, forelimb flexion tests are referred to as fetlock flexion tests; given the number of structures affected by the test, that appellation seems inappropriate.

Recent research in Belgium performed with a calibrated device^a measured the force applied during forelimb flexion tests. That study concluded that the force applied and the test results obtained vary among examiners. According to unpublished data cited in the study, the response to forelimb flexion also varied from day to day. An optimum force of 100 N and an optimum time of 60 s were determined as the parameters at which sound horses did not react to passive limb flexion; even at this optimum level, 14% of the horses tested demonstrated a positive response to limb flexion. The likelihood of a positive response to flexion was increased in the Belgian study by adding more time and more force to the test, with increasing age of the horse, and with the fact that the horse was a working horse, as opposed to a stabled or pastured horse.¹

An earlier study performed in Sweden that used a device to measure the force applied during forelimb flexion tests suggested an optimum force of 140 N and an optimum time of 60 s, using the same parameters as the Belgian study.² Whether or not the force and time parameters suggested in the Belgian and Swedish studies is indeed optimum may be a matter for discussion; however, there seems little doubt that attempting to standardize forelimb flexion tests through the use of a calibrated device would be useful in their interpretation. Unfortunately, such devices do not appear to be widely used at this time. Still, the result obtained in these two studies, that the force applied to the limb significantly influences the tests results, is confirmed in this study.

Some authors assert that it is possible to flex the fetlock joint separately from the interphalangeal joint by holding the pastern while flexing the fetlock and associated structures.³ This study did not examine whether different results would be obtained between flexion tests in which the force would be directed at or about the fetlock joint from the toe versus the pastern. Interestingly, for the same amount of pressure to be applied to the fetlock by flexing the limb from the pastern as from the toe, approximately twice as much force would have to be applied to the limb (this implies that the pressure is applied at an area halfway between the toe and the fetlock joint). This is because when the toe is used as the point from which pressure is applied, instead of the pastern, a longer lever is created. With the use of a longer lever, more pressure can be applied to the fetlock joint with less force than if the pastern is used as the point from which the flexion force originates.

Some authors suggest that it is important to minimize the degree of carpal flexion when performing a forelimb flexion test. By this, an attempt is made to differentiate an upper and lower forelimb flexion test.⁴ It does seem reasonable to think that firm flexion of the carpus would be more likely to affect that joint adversely than if carpal flexion were minimized (and would add one more variable for interpretation of the test). In this study, carpal flexion was never more than 50% of maximum. However, neither this nor any other study has addressed whether or not there is a significant difference in the results obtained in lower limb flexion depending on the degree of carpal flexion.

Flexion tests appeared to have no predictive value for the occurrence of forelimb lameness in this study. Of the 50 horses initially included in this study, seven were evaluated for lameness in the 60-day period following the initial evaluation. However, none of the lameness occurred in areas that could have been reasonably predicted by forelimb flexion. From the results of this study and another study presented by the author in 1994, in which 27 of 85 horses followed for a 1-year period developed clinical lameness problems,⁵ it appears almost certain that some percentage of working horses will demonstrate lameness in a defined period following an initial examination. Unfortunately, which particular horse will eventually demonstrate lameness, at what time, and in what area appears to defy prediction, at least at this time.

Radiographic abnormalities noted on individual horses did not correspond to clinical lameness in any of the horses examined. All of the horses were deemed to be clinically sound at the onset of the study; no lameness related to any of the wide variety of radiographic lesions seen in 48% of the horses examined was observed in the 60-day period following the initial examination. In addition, the presence of a number of radiographic changes did not correlate with a positive response to normal forelimb flexion.

It is well known that bone adapts to biochemical stress. It is also well known that radiographic changes can exist on or adjacent to joint surfaces that show no other evidence of osteoarthritis.⁶ It may well be that many of the radiographic changes noted in the horses in this study represent remodeling changes caused by exercise activity. However, even changes that are obviously not related to remodeling, such as osteochondral fragments in the distal interphalangeal joint, the fetlock, or in the proximal palmar region of the first phalanx were not associated with either lameness or a positive response to flexion in this study.

A positive response to forelimb flexion tests is, in the author's experience, one reason horses may be deemed unsuitable for purchase during a prepurchase evaluation. There seems to be a wide range of significance attributed to these tests that varies according to the opinion and, presumably, the experi-

ence of the examiner. The author has experienced and has been informed of prepurchase evaluations that were immediately discontinued solely because of a positive response to a flexion test in one or both forelimbs. Because of the variable response to this test based on the force applied, duration of the test, age of the horse, and the day of examination demonstrated in this and other studies, discontinuation of a prepurchase examination based solely on a failed forelimb flexion test is probably not warranted.

In the author's experience, owners and trainers are increasingly skeptical of the significance of forelimb flexion tests during prepurchase evaluations. A horse that won't pass flexion may result in a lost sales opportunity or force the seller to renegotiate his price to entice the potential purchaser to assume the risk (presumably of incipient lameness) of the horse that responds in a less than optimum fashion to a forelimb flexion test. When problems with flexion tests and lost sales opportunities occur in horses that have been observed to be free of lameness for some time before (and after) their examination, the skepticism of the owners and trainers seems justified. The author has seen clinically sound horses, who have been in his care for many months, who have been free of lameness problems subjected to a series of prepurchase evaluations, with the ultimate purchaser being the individual who retained a veterinarian who either discounted or did not observe a positive response to a forelimb flexion test.

Some owners and trainers apparently feel that there is a potential for hurting a horse with forelimb flexion tests. They are concerned that by flexing the joint, one could apply sufficient stress to the tissues to injure them. No signs of such a problem were seen in this study. Nor were signs of injury caused by flexion tests seen in the Belgian study, in which horses were subjected to as many as six flexion tests a week.

It is certainly reasonable (and advisable) for veterinarians to limit their potential liability during a prepurchase evaluation by restricting their opinions about the horse being examined to those facts that their examination can support. Thus, AAEP guidelines for prepurchase evaluations recommend against making positive assertions as to a horse's ability to perform an intended use. However, it also seems reasonable to avoid making negative assertions regarding a horse's current or future performance based on a positive response to a forelimb flexion test when those assertions cannot be supported by any firm data. Horses can and do perform well for a variety of riding endeavors even when they do not perform well on a forelimb flexion test.

5. Conclusions

The response to forelimb flexion tests must be interpreted in light of clinical findings such as joint effusion, reduced limb or joint flexibility, pain to palpation, or clinical lameness in the limb that

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demonstrates the positive response. Radiographic findings of such things as osteoarthritis that correlate with a positive response to forelimb flexion may add some significance to a flexion test as well, particularly if there is concurrent clinical lameness. However, this study also suggests that many radiographic abnormalities occur in clinically sound horses. Studies documenting radiographic changes that occur in sound horses or that follow the progression of radiographic lesions over time are lacking and are sorely needed.

It is apparent from this and other studies that many otherwise normal horses will demonstrate a positive response to forelimb flexion tests and that the response varies directly with the force applied to the limb. Reliance on this test to detect subclinical lameness or predict future problems seems, at best, unwise.

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^aFlextest, Krypton Electronic Engineering, N.V. Research Park, Interleuvenlaan 86, 3001 Leuven, Belgium.