Contradictions in Current Horseshoeing Theory

"Trimming to Achieve Pastern Axis Alignment vs. Trimming to Match Angle Pairs"

Farriers have long been taught many theories to balance a horse's foot and leg. One common goal of balance is to try to achieve Pastern Axis Alignment. By definition, Pastern Axis Alignment (PAA) is achieved when P1, P2, and P3 are in linear alignment, neither broken backward nor forward. Another common approach to balance is to match angle pairs, meaning match the right front dorsal angle to the left front, and the right hind to the left hind. However, the later theory assumes that horses are designed to have matched angle pairs. It is my conclusion based on a study I completed in the mid 1990's that horses are not necessarily designed with matched angle pairs. In this particular study, the data clearly shows that the great majority of horses do not possess matched angle pairs. In over 50 horses in this study, there were no instances of matched angle pairs found.

What first got me interested in investigating this theory more closely is the fact that throughout my career I noticed slight to major variances in the feet I worked on. Even when I would do everything I could to match the angles of the pairs of feet at a given shoeing period, by the next reset the feet had changed back to the same basic mismatched configuration they had before the last shoeing. Once I became more conscious of this fact, I paid closer attention to these phenomena and even questioned some of my fellow farriers to see if they noticed similar findings, which many did. Along with the help of others, I developed a more scientific and documented plan to test this theory. The procedures, results and conclusions follow:

Study Methodology:

There were 52 horses included in this study and 50 fields of data entered for each horse.

General Fields of Data Recorded:

1. Sport	2. Breed	3. Age	4. Habitat	5. Weight
6. Height	7. Owner	8. Horse's Name	9. Level of Use	10. Date of Exam

Measurement Fields of Data Recorded:

The following measurements were recorded for each hoof on each horse before the horse was trimmed and then again after the horse was trimmed.

1. Toe length.
2. Angle with dish.
3. Angle of the top inch.
4. Distance to break over [breakover point]
5. Shoe size

Data Groups:

1) Sport: There were ten (10) different sports or activities that these horses were engaged in.

Dressage – 16	Pleasure – 12	Trail – 4	Endurance – 4	Packing – 3
Barrel Racing – 2	Halter – 2	Jumpers – 6	Gaited Classes – 1	Western Pleasure - 1

2) Breed: There were thirteen (13) different breeds in this study.

Quarter Horse – 11	Thoroughbred – 10	Arabian – 7
Appaloosa – 3	Appy/Arab – 1	Warm Blood – 6
Mustangs – 3	Paint Horse – 4	Appy/Quarter – 1
Tennessee Walker – 2	Arab/Quarter – 2	Pony – 1
Appy/Tennessee Walker (walkaloosa) - 1		

3) Age: Horses ranged from 2yrs to 28 yrs of age. The average age was 10 yrs.

4) Habitat: There were 4 specific & 1 general categories for habitat.

a. Stall - 5 horses
b. Paddock - 5 horses
c. Pasture - 16 horses
d. Wide Open/Range habitat - 9 horses
e. The remaining horses lived in a combination of Stall/Paddock/pasture

5) Weight: Horses ranged from 555 lbs. to 1800 lbs. The average weight was 1100 lbs.

6) Height: Horses from 12 hands [pony] to 18.3 hands [warm blood] were recorded. The average height was 15.1 hands.

7) Level of Use: Horses were classified into 3 levels of use or activity.

a. Light - 7
b. Moderate - 25
c. Heavy - 20

8) Dates: All horses were recorded in1996. *Names of horses and Owners will not be published here.*

Results:

Measurement Taken in Inches (Average of All Horses) [standard deviation in ( )]	Before Trimming (Standard deviation)	After Trimming (Standard deviation)
1. Toe Length - Front	3.71" (.3739)	3.32" (.1996)
2. Toe Length – Hind	3.70" (.3491)	3.42" (.1961)
3. Front Angles with Dish	54.14° (2.8646)	56.37° (2.3763)
4. Front Angles – Top 1 inch of Dorsal Wall	56.24° (3.4808)	57.14° (2.7089)
5. Hind Angles with Dish	54.33° (2.5842)	56.10° (2.0373)
6. Hind Angles – Top 1 inch of Dorsal Wall	54.91° (2.7770)	56.30° (2.0140)
7. Break over Point – Fronts (From True Frog Apex)	2.06" (.3547)	1.69" (.2663)
8. Break over Point – Hinds (From True Frog Apex)	1.90" (.2703)	1.63" (.2024)
9. Average Shoe Size - Fronts	#1.05 (1.0638)	#1.10 (1.0360)
10. Average Shoe Size - Hinds	#0.73 (.7742)	#0.79 (.7895)
11. Front Angle Difference – Top 1 inch of Dorsal Wall	3.72° (3.1536)	2.16° (2.5314)
12. Hind Angle Difference - Top 1 inch of Dorsal Wall	1.84° (.8014)	1.38° (.6232)
13. Front Angle Difference with Dish	2.30° (1.8610)	1.88° (1.4000)
14. Hind Angle Difference with Dish	1.50° (.9235)	1.25° (.6680)
13. Angle of Steeper Front Foot with Dish	55.32° (2.6301)	57.34° (2.1394)
14. Angle of Lower Front Foot with Dish	52.78° (2.7413)	55.26° (2.2285)
15. Angle of Steeper Front Foot -Top 1 inch of Dorsal Wall	58.11° (3.0427)	58.45° (2.5938)
16. Angle of Lower Front Foot – Top 1 inch of Dorsal Wall	54.38° (2.8554)	55.84° (2.1460)

17. Angle of Steeper Hind Foot with Dish	55.23° (2.5752)	56.90° (1.7209)
18. Angle of Lower Hind Foot with Dish	53.50° (2.6586)	55.57° (1.6583)
19. Angle of Steeper Hind Foot –Top 1 inch of Dorsal Wall	56.84° (2.6098)	56.95° (1.9268)
20. Angle of Lower Hind Foot –Top 1 inch of Dorsal Wall	53.99° (2.6522)	55.54° (1.8244)

Definition: Standard Deviation – Describes how much the distribution clusters around its middle value (or around the average).

Minimum & Maximum Measurements:

Measurement Taken	Minimum	Maximum
1. Toe Length	1.89”	5”
2. Front Foot Angle	48°	66°
3. Hind Foot Angle	47°	61°
4. Break over Point (From the True Frog Apex)	0.79”	3”
5. Shoe Size	#0000	#6

Where the Minimum & Maximum Occurred:

1. The shortest toe length was on a pony as was the shortest distance to break over.
2. The longest toe length was on a plantation shod Tennessee walking horse.
3. The greatest distance to breakover was on the steepest clubfoot with 11° difference between the angle with dish [the overall angle] and the angle of the top inch of the dorsal wall.
4. The smallest shoe size was on a pony. The largest shoe size was on a Warm Blood.

How the Measurements Were Taken:

- All angles and toe lengths were measured using only one tape measure and one hoof gauge.

- Toe lengths were measured from the hairline [where skin meets horn] to the most distal edge of the wall at the center of the toe.

- Angles were gauged by measuring the overall angle of the dorsal wall top to bottom [angle with dish] and the angle of the dorsal wall from the hairline down one inch (1”). [Angle - top inch] (See Figure 1.)

- Break over point was measured from the true apex of the frog [where the live point of the frog meets the live sole] to the point of actual breakover.

- Trimming into the live sole, or rasping through the inner stratum of the wall was avoided.

Figure 1

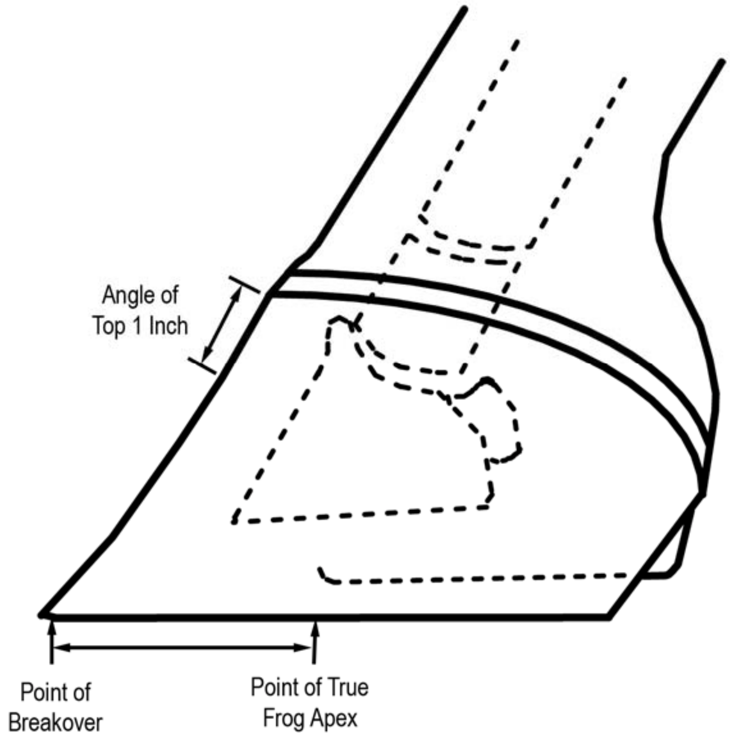
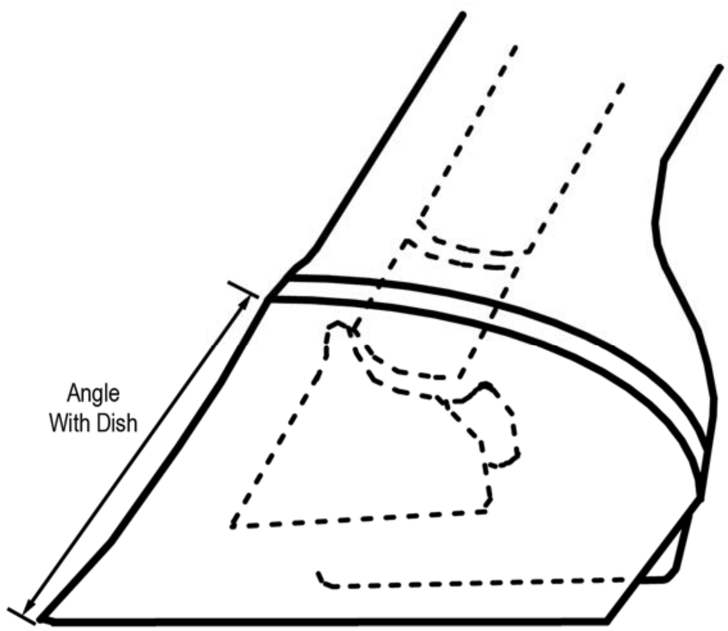


Figure 2



<u>Noted Tendencies:</u>

1} On average, the length from the tip of the frog to the breakover point was reduced by 4/10's inches during the trimming & shoeing process.

2} Angles increased by 2-3 degrees during the trimming process.

3} There was a trend between dishing and greater distance to break over. The more dishing that is created on the dorsal wall the greater the distance from P3 to the point of breakover.

4} The steep feet occurred 80% of the time on the diagonal. [RF, LH or LF, RH]. They occurred 20% of the time on the lateral. [RF, RH or LF, LH].

5} No instances of matched angle pairs were found.

<u>Note:</u>

These averages are for this particular group of horses and should not be used to determine lengths and angles to trim to on individual horses. These numbers could change depending on the herds observed. For example, if 50 ponies or 50 warm bloods were studied, toe lengths, angles, shoe size, breakover points, etc. would be vastly different. Toe lengths, angles, etc. are determined or established by size of horse, sport, environment, conformation, etc. **Averages do not represent any individual horse and should not be imposed on a given horse.**

<u>Conclusion:</u>

Using the supportive data that horses do not naturally possess matched angle pairs, as is obviously the case in the club footed horse; let's examine the contradiction of trying to achieve both PAA, and matching the angles in pairs. These same results are seen in the normal, mismatched horse, as well as in the clubfooted horse, however it is much more obvious when seeing it on a clubfoot and a low foot.

If we first trim to achieve PAA with a clubfoot and a low foot, we can assume an angle difference of 6+ degrees. Say we achieve PAA, or as close as possible, by trimming the horse to 61 degrees [club foot] and 55 degrees [low foot], this would theoretically balance the pull between the flexor and extensor apparatus on each lower leg. If we then want to match the angle pairs we would have to trim the heel on the steep foot, possibly into the live functional sole, while leaving as much toe length out front as we can. In contrast, but at the same time, we would be encouraged to leave the heel on the low foot, even though this heel is often crushed and of poor quality horn. We would also be inclined to trim the toe of the low foot as short as possible, and dress the dorsal wall back, once again possibly invading the live sole at the toe and overdressing the inner stratum of the dorsal wall. The major flaw in this approach is that if we have already achieved PAA at 61 and 55, then when we trim to 58 on both feet neither will be in PAA, and we would have had to invade sensitive solar structure to get it done. It would also appear that we have unbalanced the flexor-extensor relationship. Furthermore as we continue to try to match the angle pairs we will increase the tension on the flexor apparatus on the steep foot resulting in a dishing effect on the dorsal wall. As the dorsal wall migrates forward on the steep foot, and we continue to dress the dorsal wall on the low foot, the steep foot will end up with more wall in front of P3 than the low foot, thereby creating an imbalance in breakover. This delayed breakover may create enough strain on the flexor attachment to P3 to cause serious injury. The Distal sesmoidian ligament and distal sesmoidian collateral ligaments will also be at risk.

According to many of the guidelines that farriers are taught, in order to achieve matched angle pairs would mean invading live sole at the heel or the toe. Evidence shows that this practice can compromise the attachment of the sole and inner stratum of the dorsal wall at the ground level, thereby causing the destabilization of the P3/dorsal wall connection. This may be a contributing factor to thin soles, which seem to be a common problem that arises when trying to match angle pairs.

Further evidence shows that if we radiograph the steep foot and the low foot, prior to trimming, then re-radiograph after the trim, and compare these films 3 and 6 months later, the horse will continually pry the dorsal wall away from P3 on the steep foot creating more dishing in an effort to regain the natural angle on the steep foot. The heels on the low foot will generally crush to the height of the frog in an effort to return to its natural angle. And generally the soles will be thinner.

Another aspect to consider is the relationship of front feet and hind feet traveling on the diagonal at a trot, and on the lateral at a pace. Since horses naturally possess mismatched angle pairs, altering the steep front foot also challenges the front to hind relationship. As you can see, matching angle pairs starts to create many imbalances in the horse. The horse is an asymmetrical quadruped, and it is through this asymmetry that the horse achieves its balance.

As an alternative to trying to match angle pairs by conventional methods of trimming through the live sole at the toe or heel, or over-dressing the dorsal wall by rasping through the inner stratum of the hoof wall. Farriers should consider alternate means to successfully balance each foot individually. There are several theories that use the live, functional sole as a guide for both anterior/posterior and medial/lateral balance, as opposed to relying on set hoof capsule angles that may or may not be a true representation of coffin bone or pastern angles. I personally use Natural Balance principles because they offer some unique hoof mapping techniques to identify the live sole and natural angle. These principles also help me locate landmarks so that I can place the shoe and breakover in an anatomically and physiologically sound location, providing support to the entire foot instead of just the anterior portion of the hoof capsule. Although it is not necessarily a goal of these principles, I have noticed that this generally matches the angle pairs as closely as nature has intended. I believe this helps a horse achieve his/her healthiest natural conformation, whereby he/she may operate at their highest level of biomechanical efficiency. I find that this method of trimming is compatible with, and effectively achieves the goals of maintaining PAA. Again, this is my own personal preference. I encourage every farrier to consider this information, and then look at the various modalities available (past and present), and use what works best for them.

- *It should be noted that certain horses might not safely be trimmed to achieve PAA. It's not recommended that the live sole be invaded or the inner stratum of the wall be rasped through in order to achieve PAA. Cases where PAA may not be possible might include horses with a grade 2 or greater clubfoot, horses with extremely broken forward pastern axis, horses with a negative P3 plane, or horses with extremely broken back pastern axis. These horses may need the help [indefinite or temporary] of an appliance to be sound or useful. I consider these horses to be physically handicapped. One must also appreciate that most horses can probably function soundly within a reasonable range of PAA.*

<u>Summary</u>

- Trimming to maintain PAA appears to benefit the horse, depending on the trimming methods used. However, **ONLY Trimming to Match Angle Pairs** does not benefit the horse. There must be other considerations that take precedence.

- Over-dressing of the dorsal wall destabilizes the hoof capsule. This is not beneficial to the horse. This also does not keep angles matched, and can in fact lead to further angle disparity down the road if continued. It may also cause a slight rotation of P3 within the hoof capsule.

- Trimming through the live, functional sole ridge at the toe is very detrimental to the horse. It can cause excessive sole pressure, vascular compression, bruising, and possible P3 fractures. This may also cause slight rotation or descending of P3 within the hoof capsule.

- Each foot on the horse is slightly or radically different from its opposite foot. However it is the combination of four different feet that creates the balance in the horse. Balance each foot and the horse will be balanced.

- Investigate trimming and shoeing modalities that use a range of guidelines to both map out and prepare each foot individually. Get familiar with finding and using the live, functional sole as a guide. Keep in mind that you can't use it as a guide if you have already invaded it. I believe that if you find out how to read these structures, and don't get too dependent on matching angles, you will encounter fewer occurrences of hoof capsule distortions and the pathologies associated with them. I find these methods take some of the complexity out of trimming and shoeing, they help horses avoid shoeing related injuries, and they are compatible with the way horses are naturally designed.

I hope this information has offered some food for thought. I encourage you to investigate these theories for yourself. If you decide to employ these guidelines for attaining balance, ease into it, be conservative. Work with a farrier or veterinarian that is competent using these methods before you start. You can observe the results for yourself by the way the horse responds. The more we help our equine friends remain sound, the higher we elevate our craft in the eyes of the horse industry.

Yours in the forge,
Pat Thacker

Pat Thacker has been a professional farrier for 27 years. He graduated from Cal Poly farrier science program under Gene Armstrong in 1979, and is currently the president of the Idaho Farriers Network. Pat is the owner and operator of the Equine Hoof Soundness Clinic in Eagle, Idaho, where he incorporates the principles of Natural Balance in the treatment of chronic and acute lameness cases. Pat specializes in shoeing performance horses using these same guidelines since 1991, when he first became exposed to Natural Balance. Pat has evolved, along with the principles of Natural Balance over the last 14 years, and is recognized by the EDSS Corporation as an educator of Natural Balance principles and guidelines. Through the Equine hoof soundness clinic, Pat Thacker teaches horse owners, veterinarians and farriers of all levels how these guidelines can be implemented into their hoof care practices to help maintain and improve the soundness level of the horses they work with. Mr. Thacker can be reached by calling (208) 283-6525.