Glue-On Technology and an Innovative New Technique

Derek Poupard, CJF, Dipl WCF

Glue-on shoe technology offers another means to attach a horseshoe to the surface of the equine hoof when a non-nailing, atraumatic alternative is indicated. Author’s address: Zabeel Racing Stable, Dubai, United Arab Emirates; e-mail: derek@quixshoe.com. © 2010 AAEP.

1. Introduction
Alternative methods of securing shoes to the equine hoof without nails have become possible with the development of various composite adhesives. Composite adhesives, such as polymethylmethacrylates and urethanes, are comprised of two parts, a resin and a catalyst, that, when mixed together, polymerize in a matter of minutes to form a bond between the hoof wall and the shoe.

The attachment of a shoe to the hoof wall with an adhesive offers several advantages over the use of nails. Nailing shoes may be traumatic, particularly when there is insufficient or poor quality hoof wall to allow the use of nails. Nails, when misplaced near or in the sensitive dermis, may lead to lameness and possible infection. Composite adhesives can also be used remedially to place the shoe in a more appropriate position to change the forces on a foot (for example, lateral or medial extensions). They can also be used to raise, reconstruct, or extend the ground surface of a weak or collapsed heel or as a therapeutic option in specific disease processes (for example, the realignment of P3 for treating chronic laminitis).

Precautions that should be observed when applying these adhesives include but are not limited to the following:

- Wear gloves and use in a well-ventilated area.
- Examine the foot thoroughly for tracts that may lead to sensitive tissue or indicate an underlying infection.
- Explore the origin of the tract to avoid failure in application and possible lameness.
- Provide an interface for any soft or suspicious areas with putty.
- Be aware that the high exothermic heat generated during polymerization may be uncomfortable to thin-walled horses.

The nature of adhesives has been known to cause hoof-wall degeneration with prolonged use, and it should be recognized as a short-term solution to facilitate the return to traditional horseshoeing.

2. Methods of Application
There are numerous methods of applying glue-on shoes that are widely recognized and accepted by veterinarians and farriers in the field of podiatry. Among the methods are:

1. Attaching the shoe to the outer hoof wall with an attached cuff and composite (Fig. 1).
2. Attaching the shoe directly to the ground surface of the hoof with composite placed between the shoe and the hoof (Fig. 2).

3. Using elastic-encased shoes with plastic tabs that extend from the perimeter of the shoe up the outer hoof wall and adhere to the hoof wall with cyanoacrylate adhesive (Fig. 3).

4. Using a recently introduced composite-injection technique that produces a shoe that bonds directly to the hoof wall (Fig. 4).

3. Attaching the Horseshoe Using a Cuff

Preparation and Application

The foot is trimmed appropriately using the following guidelines:

- The hoof-pastern axis (HPA).
- The center of articulation.
- The extension of the heels to the base of the frog.

These guidelines can serve as landmarks for trimming. The use of these guidelines can provide standardization in the basic approach to farriery to veterinarians and farriers.

- The outer hoof wall is cleaned using a rasp.
- The shoe is shaped to fit the foot as a conventional shoe fit to the widest point of the heels and leveled; the fabric cuff is contoured to the outer hoof wall.
- The surface area of the outer hoof where the cuff will be attached is primed (composite rubbed into the wall with gloved fingers and spread into a thin layer).
- A thicker layer of composite is then applied to the fabric cuff attached to the shoe and spread evenly on the wall-attachment side of the cuff.
- The shoe is placed on the foot, and the fabric cuff is positioned onto the hoof wall by manipulating the cuff and composite with gloved fingers into the desired position.
Plastic wrap is applied in a figure-eight pattern to cover the entire foot, smooth out the cuff, and secure the shoe and cuff to the foot while the composite cures. The foot can now be placed on the ground until the composite has cured. The outer hoof wall and cuff can then be rasped as needed to produce an aesthetic finish.

Advantages
- Excellent wear capability of aluminum shoe.
- Sole clearance can be attained because of the predominant wall attachment of the cuff.
- Good strength of adhesion with the fabric cuff.

Disadvantages
- High exothermic heat from composite curing.
- The wall degenerates after numerous applications.
- Shoe shaping and leveling with the cuff may be restrictive.
- Placement of the shoe may be difficult.
- Time consuming.
- Cost.

4. Attaching the Shoe Directly to the Hoof
An aluminum shoe is attached with a composite to the ground surface of the foot.

Preparation and Application
The foot is trimmed appropriately.
- The outer hoof wall is cleaned using a rasp.
- The final preparation of the ground surface of the foot and in up the outer hoof wall is accomplished by sanding with a drum sander attached to a Dremel tool. The prepared surface is washed with acetone, dried with a heat gun, and placed in a clean cloth boot.
- The shoe is shaped to fit the foot as a conventional shoe with more expansion at the heels, and the bearing surface of the shoe is roughened using a grinder. Grooves may also be cut into the surface of the shoe using a grinder to facilitate a more secure bonding.
- The foot is primed with a thin layer of composite.
- The composite, which has been mixed with fiberglass strands, is applied evenly to the shoe or applied directly to the hoof.
- The shoe is now placed on the foot in the desired position.
- Plastic wrap is used to cover the entire foot, and the composite is smoothed to follow the contour of the heels.
- The foot is held non–weight-bearing until the composite has cured.
- The composite can then be rasped as needed to produce an aesthetic finish.

Advantages
- Excellent wear capability of aluminum shoe.
- No special shoes or tools needed.
- Can be applied to little or no hoof wall.
- Shoe placement can be manipulated with ease.
- Can be used with shoe liners for sensitive soles with little or no bonding disadvantages.
- Speed of application.
- Cost effective.

Disadvantages
- High exothermic heat from composite curing.
- Limits expansion and contraction of the hoof.
- The wall may degenerate after numerous applications.

5. Attaching the Shoe Using Plastic Tabs
An aluminum shoe that is encased in plastic with attached tabs around the circumference of the horseshoe is used in this method and is attached to the hoof wall with a cyanoacrylate adhesive.

Preparation and Application
The foot is trimmed appropriately.
- The outer hoof wall is cleaned using a rasp.
- Sandpaper is used to prepare the surface of the outer hoof-wall surface where the tabs are to be applied.
- The shoe is then shaped to fit the foot and leveled, and the tabs are contoured if needed.
- The tabs are glued to the outer hoof wall, gluing from the base of each tab and moving upward using the supplied adhesive.
- The cyanoacrylate adhesive has instant adhesion properties. Caution and detail must be applied with the positioning of each tab.

Advantages
- Excellent wear capability of aluminum shoe.
- Speed of application.
- Does not restrict foot expansion and contraction at the heels.

Disadvantages
- Difficulty in shaping and leveling.
- Tabs dictate shoe placement.
- Hoof-wall degradation exists, although they are not as severe.
- Will not glue to a composite.
- Heel elevation and pastern alignment cannot be achieved successfully.
- Cost.
6. Attaching a Shoe Directly to the Hoof Using a Silicon Mold

This method uses an in situ shoe mold to create a horseshoe from injected composite that adheres directly to the surface of the hoof wall and sole. This mold is manufactured from translucent silicone, and because of its properties, it will not adhere to a urethane composite. The cavity within the mold dictates the shape and style of the applied shoe.

Preparation and Application

- Again, the foot is trimmed appropriately, and the outer hoof wall is prepared with a rasp extending 2 in up the hoof wall from the ground surface.
- The mold is assessed to fit (Fig. 5) by ensuring adequate heel coverage and symmetry from the apex of the frog to the inner rim of the mold.
- The sole is pared to remove all exfoliating horn, and then, it is wire brushed thoroughly. A butane torch is used on the hoof wall and corresponding sole to dehydrate the hoof of moisture using rapid movements so as not to burn the foot.
- The hoof is then placed into the mold and secured in place with the attached Velcro strap (Fig. 5).
- The composite is injected into a toe hole of the mold until it is seen to travel in both directions to the corresponding holes, which are then injected until the shoe is formed (Fig. 6).
- The foot is held non-weight-bearing until the composite has cured.
- The mold is removed from heel to heel (Fig. 7), and the injection points are cut flush with the shoe surface. The newly created in situ horseshoe is now securely attached to the hoof wall and sole (Figs. 8 and 9).
- Because of the increased heel height created with this system, a polyurethane composite palmar sole support is added to support the soft-tissue structures such as the frog corium, digital cushion, and ungual cartilages (Fig. 9).

Advantages

- Speed and ease of application.
- Shoe becomes an extension of the foot with similar expansion and contraction capabilities.
- Being a composite shoe, the breakover can be dictated after it has been applied.

Disadvantages

- Exothermic heat from composite curing.
- Cost.
- Wear capability of a composite shoe.
- High maintenance in wet climates.
- High heel elevation that needs palmar solar support.
7. Conclusion
Glue-on shoes can be used for damaged hoof walls and hoof walls with poor horn consistency that will benefit from not having nails used to attach the shoe. Some therapeutic conditions that may warrant a non-nailing technique are acute or chronic laminitis to align the P3 and HPA\(^5\) and extensive hoof-wall separations (white line disease), resections, or avulsions of the hoof wall to immobilize and support distal phalanx fractures\(^5\) and severely damaged heels. Long toe and underrun heel-foot conformation may lead to a chronic low-grade lameness\(^2\) and presents a challenge for veterinarians and farriers to manage. The composite can be used to extend the heel farther palmarly/plantarly, and when combined with the appropriate shoe, the extended or created heel is placed in a better functional position under the limb. Furthermore, the composite that is placed between the shoe and the foot prevents the abrasive movement of the heel of the foot against the shoe. The composite between the foot and the shoe does not seem to inhibit normal heel expansion, and the author has seen no indication of contracted heels after this type of application. However, there are disadvantages as well. The glue-on shoes are expensive, time consuming, and require a certain amount of expertise; additionally, the application of adhesives to the side of the wall may decrease the quality of the underlying wall when used continuously. There is also a perception that glue-on shoes do not stay on as well as nailed-on shoes, but this impression is, in part, the result of poor case selection or poor application. Each of these methods has merit, and product choice is often based on the individual’s familiarity with each method and composite material.

Glue-on shoes should be considered a transient device to produce hoof mass or treat a given hoof abnormality before reverting back to traditional shoes or leaving the horse barefoot.

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References and Footnotes

\(^{a}\)Equilox International Inc., Pine Island, MN 55963.
\(^{b}\)Vettec Hoof Care Products, Oxnard, CA 93033.
\(^{c}\)Sound Horse Technologies Inc., Unionville, PA 19375.
\(^{d}\)Mustad International, 1000 Lausanne, Switzerland.
\(^{e}\)QuixShoe, Dubai, United Arab Emirates.