Tack Fit and Use

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KEYWORDS

• Saddle • Bridle • Bit • Equestrian sport • Pressure • Pain • Atrophy

KEY POINTS

- A variety of equipment is used by riders to facilitate control of the horse.
- Equipment should fit correctly and be effective but not coercive.
- Signs of ill-fit or misuse of equipment should be recognized.
- Familiarity with correction of tack fitting problems is beneficial.

INTRODUCTION

Tack is used to improve safety, comfort, and communication between the rider and horse. In order to accomplish this, the bit, bridle, saddle, and girth should be fitted and used correctly. Ill-fitting tack and insensitive and asymmetric application of the rider's aids transmitted via the tack may cause a variety of lesions, such as ulceration and bruising, that interfere with equine health and athletic performance. The saddle needs to fit the size, shape, and contours of the horse's back on its underside and the rider's pelvis and thighs on the upper side. The change in back contours from the relatively upright slope visualized along the lateral aspect of the withers to the more horizontal orientation beneath the rider's seat is accommodated by the twist of the saddle, which is one of several contributing factors to consider for correct saddle fit and the horse's comfort. The bridle is designed primarily to hold the bit in place and should not be used to apply extraneous pressure over sensitive tissues of the head by incorrect placement, lack of padding, or overtightening of the bridle straps (nosebands/headpieces). The size, type, and height of the bit relative to the oral cavity dimensions determines its contact with the horse's lips and commissures, bars, tongue, and hard palate. Oral lesions caused by bits may vary from commissural ulcers associated with snaffle bits or lesions of the bars related to unjointed bits (snaffle or curb). The rider can affect the development of skin lesions or injuries via their weight

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Vet Clin Equine ■ (2022) ■–■
https://doi.org/10.1016/j.cveq.2022.07.003 vetequine.theclinics.com

distribution in the saddle, ability to ride in harmony with the horse, and skill in applying light and consistent aids.

Challenges inherent in correct fitting and use of equipment are similar across disciplines and center around the following principles:

- Saddle fit should allow unhindered back and shoulder movement
- The saddle needs to accommodate changes in the shape of the horse's back over time
- The bridle should fit and be adjusted correctly, particularly with regard to noseband tightness
- Oral lesions are often present in sport horses and warrant greater awareness and understanding
- Coercive riding techniques should not be condoned

THE SADDLE

Saddles were developed primarily to improve comfort of the horse by distributing the rider's weight over the horse's back. Safety was also an important factor by providing the rider with a more stable platform on which to ride the horse. Saddle design should address the following:

- Account for the disparate shapes of the horse's back versus the rider's pelvis and inner thighs
- Allow for shape changes of the horse (and perhaps the rider) over time
- Correct fit in the static and dynamic horse
- The bones and muscles of the horse's shoulders and back need to move beneath the saddle
- The saddle's balance on the horse's back
- The rider's ability to ride in harmony with the horse

From the horse's standpoint, the saddle should support three-dimensional movements of the subcutaneous musculoskeletal tissues and scapula, including the superficial scapular and trunk muscles, and the thoracic vertebrae and ribs.

The following text describes the structure and fitting of an English saddle. Most English saddles are built around a tree that provides a degree of rigidity and a mechanism to distribute the forces due to the rider. Modern trees have a little flexibility to accommodate movements of the horse's back. The pommel and cantle refer to the elevated areas at the front and back, respectively, of the saddle. The panels on the underside form the interface between the saddle and the horse's back and are padded to accommodate the changing contours of the back and help to distribute and reduce saddle pressures.

Different groups have slightly different recommendations for saddle fitting. The Society of Master Saddlers, a certificated society in saddle and bridle fit, provides the following guidelines for fitting a saddle to a static horse:

1. General feel of the saddle
2. Width and shape of the head plate closely matches the contours of the horse
3. Correct tree positioning with the scapula free to rotate
4. Weight-bearing part of the panel does not extend beyond T18
5. The gullet clears the spinous process of the withers and midline of the back
6. Girth straps align with the girth groove
7. Saddle is balanced craniocaudally and stable laterally
8. Panels have smooth, consistent contact with the horse's back

9. Rider fit

Assessment is subjective and for some criteria, trained saddle fitters do not show a good level of agreement in assessing the adequacy of saddle fit.[1] Notably, features that are not visible externally, particularly those related to the angle of the tree points (tree width) and tree length are the most difficult to assess. It was also found that saddler height was a limiting factor with saddlers who were short in stature having more difficulty in accurately assessing saddle fit.

Observation of the horse's back from above shows how back shape changes within the saddle contact region. On either side of the withers, the trunk slopes quite steeply downward over the lateral chest wall but in the mid-to-caudal thoracic region, the slope is more horizontal. This change in contour is accommodated by the twist in the saddle tree where the underside changes from a relatively narrow V-shape over the withers to a broader, flatter shape behind the withers. This changing contour is one of the more difficult aspects to evaluate while assessing proper saddle fit. A saddle with a narrow twist can create localized bilateral pressures in the epaxial muscles at the level of T10-T13. These pressures were of sufficient magnitude to affect gait when trotting,[2] jumping,[3] and galloping.[4] When pressures were reduced with saddlery modifications, gait features were altered, highlighting the importance of correct saddle fit and the effect that areas of high pressures induced by saddle design can have on equine locomotion.

The head plate of the English saddle is the rigid element that connects the left and right sides of the tree and forms the elevated front portion of the saddle (ie, pommel; **Fig. 1**). Its width and angulation should correspond to the shape of the dorsal wither region with proper width at the apex to provide clearance of the spinous processes and outward angulation of the points to provide uniform contact and weight distribution of the rider. Wither conformation may change with age and level of training, so fit of the head plate and saddle must be checked periodically.

If the head plate is too wide or the angle is too large (**Fig. 2**), the saddle will not be sufficiently supported and the tree will slide down and place abnormal pressure on the top of the withers, with a tendency for pressure to be concentrated along the caudal border of the scapula[5] and create localized bilateral pressures in the epaxial muscle lateral to T10-T13. When the saddle is removed, the presence of dry patches of

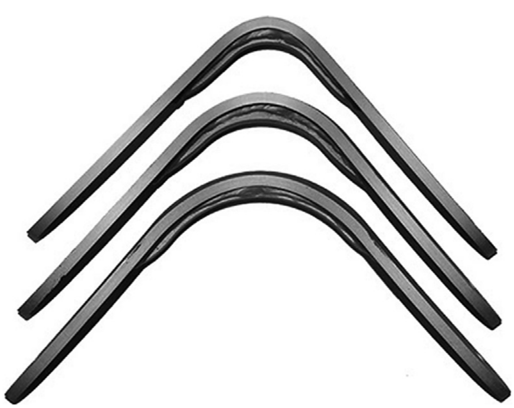

Fig. 1. Three head plates with the same overall angulation but with different apex widths and shapes. The lower part of the tree points, which are within the panels, should match the curvature of the horse's back. (Courtesy WOW Saddles.)

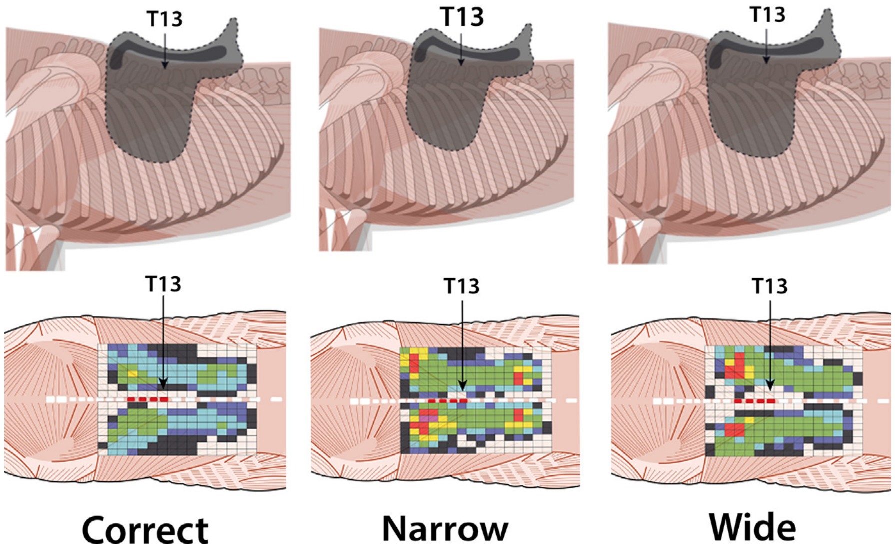

Fig. 2. Saddle positions (*above*) and typical pressure scans (*below* with 4 red cells along the midline of the pad) for, left to right, a saddle correctly fitted (*left*), too narrow (*middle*), and too wide (*right*). The correctly fitted saddle on the left shows a fairly even pressure pattern on the horse's back. The narrow saddle (*center*) has the pommel high, the cantle low, and the seat slopes backward. The narrow saddle can bridge, causing 4 high-pressure areas (*red and yellow colors* in the pressure scans): 2 cranially and 2 caudally. The wide saddle (*right*) is low in the pommel high in the cantle, and the seat tilts forward and downward. Localized high-pressure areas are seen cranially on each side of the withers in the accompanying pressure scan. Cranial to the left in all images.

skin on the side(s) of the withers surrounded by normal sweat patterns reflects saddle pressure sufficient to cause sweat gland ischemia.[6] Localized muscle pain and concavities in the epaxial muscles (trapezius, rhomboideus thoracis, longissimus dorsi) may be palpable in the affected area soon after exercise and over time. An excessively wide head plate may drop low enough to apply direct pressure to the spinous processes of the withers.

If the head plate is too narrow or its angle is too small, the pommel of the saddle will be visibly elevated with the saddle appearing to be tilted backward. A common observation with a narrow tree is bridging in which there are 4 points of pressure. Bilateral areas of localized high pressures in the epaxial muscles, lateral to T10-T13 and caudal to the scapula (longissimus, cutaneus trunci, latissimus, deep pectoral) can often be found due to the narrow saddle. Due to the "bridging" bilateral pressures are also concentrated in the region lateral to T16-T18. The cranial-caudal pressure pattern induced by a narrow saddle can span from the medial part of the long back muscles[5] and laterally. The mid-thoracic part of the back is a relatively unloaded area between (see Fig. 2). Physical examination may show signs of muscle pain or atrophy in the heavily loaded areas. Both wide and narrow saddles may negatively affect trunk function and limb movement patterns.[7]

The twist of the tree should match the horse's back contours to accommodate the three-dimensional change in angle between the withers and the back. A horse with a narrow back needs a saddle with a narrow twist and vice versa. The rider's preference for more or less support between their upper thighs should be regarded as a secondary concern. Correctly fitted saddles that have a narrow twist have been associated with high pressures at T10-T13 (Fig. 3) that affect limb movement when trotting,[2] jumping,[3] and galloping.[4] Horses develop locomotor strategies to alter the area of weight-bearing on the back with the goal of alleviating discomfort caused by saddle-induced pressures.[2] Fortunately, these altered gait parameters can be improved with proper saddle fit modifications to reduce pressure at T10-T13.

The panels of the saddle provide the main surface contact area with the horse and should match the contours of the horse's back both cranial-to-caudal and left-to-right when viewed from behind (Fig. 4). If the horse has epaxial muscle atrophy or a generalized lack of muscle development and the panels are too flat, there can be a localized band of high pressure located close to the dorsal midline. If the panels slope more than the horse's back, pressure increases along the periphery of the panels.[5]

Panels vary in size, shape, flocking material used, and in their firmness, which affects the interface with and comfort of the horse. The traditional flocking material is wool, which optimally should be reflocked every few months as the horse's back shape changes and the flocking can be compressed and become hard and lumpy within the panels. Foam panels may retain their shape for a long period of time and depending on the type of foam used (closed cell) they do not disintegrate over time. However, foam is more difficult to adjust than wool. Air-flocked panels with a foam core are another option so long as they are not overinflated, which makes the panels hard and causes the back of the saddle to bounce in gaits with suspension phases pitching the cranial part of the saddle downward to create localized, high pressure areas. When inflated properly, air panels are soft and conform easily to the changing shape of the underlying bones and muscles.

The underside of the panels should be smooth without focal hard or raised areas and the edges of the panels should curve gently. The gullet should be of uniform width along the length of the saddle (see Fig. 4). In horses with an elongated wither conformation, the upper part of the gullet of the saddle may contact the spinous processes on the caudal slope of the withers. If the hair over the top or caudal slope of the withers seems ruffled when the saddle is removed, the gullet width and clearance should be checked along the entire length of the saddle. Consideration should also be given to the saddle pad being used as this may displace ventrally during locomotion.

Modular saddles with interchangeable parts are available and can be assembled stall-side so that the size and shape of the tree, the length, width, and depth of the

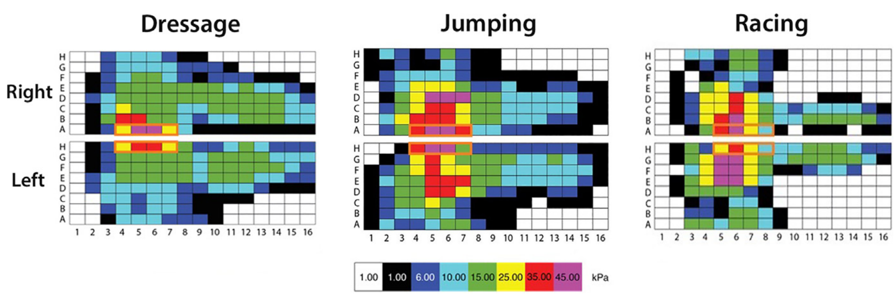

Fig. 3. High-pressure areas at the twist of the saddle are shown by pink, red, and yellow shaded cells on the pressure scan in a dressage saddle (*left*), a jumping saddle (*center*) and a full tree racing saddle (*right*). The twist of the saddle corresponds to the narrowest part of the saddle at the region of T10-13. If the twist is too narrow for the horse, it can cause localized pressures in this region, which can affect gait. Cranial to the left.

Fig. 4. Left: Rear view of a saddle with a wide gullet and panels that curve gently away from the side of the horse. Center: Underside of a foam-flocked saddle showing smooth, wide panels and wide gullet. Right: Underside of a saddle with lumpy panels and inconsistent gullet width.

panels, and the size and shape of the seat can be customized to fit the horse and rider as needed over time. This is particularly useful when fitting a young horse or one that is rehabilitating and can be expected to dramatically change the shape of the dorsal trunk.

When the horse is in motion, the saddle may move slightly craniocaudally in rhythm with the footfalls. The rider's seat and the saddle should, on average, be positioned centrally on the horse's back, although there may be some lateral motion of the back of the saddle coinciding with specific moments in each gait. The rider's seat and the caudal portion of the saddle have been reported to show consistent asymmetric or excessive displacement to one side, which is sometimes referred to as "saddle slip." Asymmetric lateral displacement of the caudal portion of the saddle has been related to hindlimb lameness, with the saddle being displaced more toward the lame or lamer hindlimb. Symmetric saddle kinematics were restored when the source of lameness was alleviated.[8] Another study reported asymmetric saddle displacement in 24% of horses with hindlimb lameness alone, 46% of horses with concurrent fore and hind limb lameness, and 5% with forelimb lameness suggesting a relationship to hind limb lameness, with or without concurrent forelimb lameness with the overarching finding that asymmetric movement of the horse (here: lameness) may affect the balance of the saddle causing it to slip to one side. Not all lame horses have saddle slip and not all nonlame horses have a saddle that remains straight. Other factors associated with saddle slip include functional/structural asymmetry of the horse that is not associated with lameness. In these horses, the primary factor(s) responsible for the saddle slipping to the side are unknown. The consensus seems to be that the horse, not the rider, is the primary causative factor; asymmetrical riders were found not to induce saddle slip.[8,9]

When the caudal portion of the saddle is displaced to one side (eg, to the right), saddle pressure increases on the contralateral (left) side in the soft tissues lateral to the midline in the region of T10-T13 and more caudally at T17-T18 (**Fig. 5**). Saddle slip only happens on one rein and generally more noticeably in walk and canter largely due to the inherent rotations of the horse's back in these gaits. It may be accompanied by asymmetries of limb movement due to changes in the rider's center of pressure and balance, together with asymmetric saddle pressures. During ridden locomotion, when the saddle slips to one side, the rider's pelvis follows the saddle while the rider's trunk

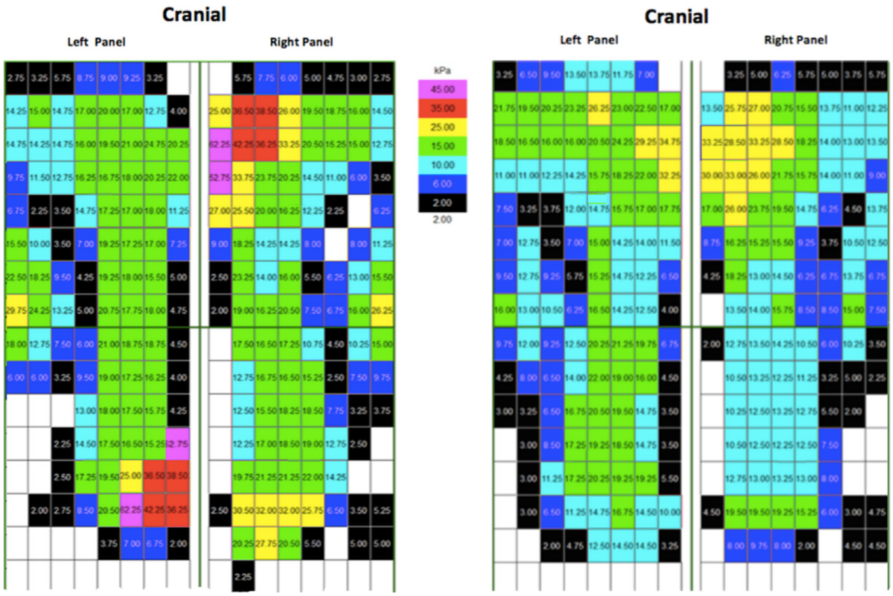

Fig. 5. Left: Pressure scan of a saddle with excessive displacement of the caudal portion of the saddle to the left with corresponding increased pressure close to the midline at the front of the saddle on the right side when in left lead canter; Right: Pressure map of the same horse and rider after saddle slip was reduced by the insertion of a shim and changing the girthing arrangement to rebalance the saddle.

compensates by leaning away from the direction of saddle displacement. In general, saddle pressure is higher on the side that the rider's leans toward.[10] As a way of determining if the horse is the primary cause of saddle slip, when walking in a straight-line without a rider, the saddle will persistently slip to one side. When the rider mounts, the saddle will follow the same movement as when walking in a straight-line without the rider.

As a temporary mechanical intervention, a saddle fitter may use asymmetric shims or flocking to alleviate areas of high pressures caused by saddle slip or use a different billet strap attachment or arrangement to temporarily correct or reduce slippage while the underlying cause is remedied. After eliminating lameness, an exercise program should be used to strengthen the horse and reduce the effect of existing functional and structural asymmetries. Riders also need to consider their own position and asymmetries; prolonged riding in a saddle that displaces to one side may have affected their functional riding ability.

Sometimes, it is difficult to find a saddle that fits both horse and rider. Some riders may choose to use treeless saddles that are purported to offer a more universal fit but, without a tree, pressure tends to be concentrated in small areas on the horse's back[11] (Fig. 6). Horses ridden in treeless saddles may have focal painful areas in the epaxial musculature at T13-T17, which corresponds to the riders contact points (seat bones). Additional padding beneath the saddle may be helpful to reduce peak pressures but the duration or intensity of ridden exercise, the rider's ability, and the athletic discipline may also be factors to consider. Some treeless saddles have the stirrup leathers suspended by a continuous band across the horse's back, which may cause localized pressures and back soreness directly over the dorsal midline.

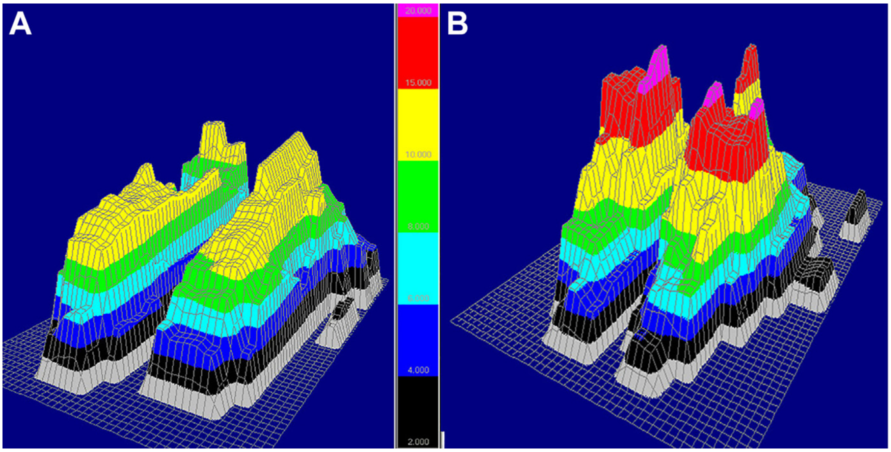

Fig. 6. Pressure maps of the same horse and rider at middiagonal stance in trot with a treed saddle (A) and a treeless saddle (B). The area of the pressure mat is shown by the white squares with the colors and heights of the individual rectangular cells on the pressure scan indicating pressure magnitude. Note the higher peak forces distributed over a smaller area for the treeless saddle.

BRIDLES

The basic English bridle consists of a headpiece and cheekpieces to support the bit, a browband, noseband, throatlatch or jowl strap, bit and reins. Similar to proper saddle fitting, the principles of pressure reduction in bridles include increasing the weight-bearing areas and adding soft padding to the underside. Firm padding is much less effective in dampening force. The padding should be easily indented by digital pressure. One bridle features a thick layer of padding that consists of material used to reduce the risk of bedsores in humans, which compresses and self-adjusts to the horse's head when tightened in place. A current trend is to use "anatomic" bridles intended to relieve pressure over sensitive areas of the head and poll region. The common features of an anatomic bridle are illustrated in Fig. 7. Other bridles apply similar principles but with variations in design and esthetics.

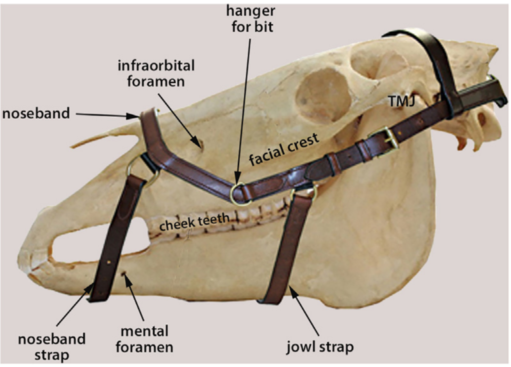

Fig. 7. Anatomic (Micklem) bridle designed to avoid exerting pressure on sensitive anatomic structures labeled on the diagram.TMJ, temporomandibular joint.

The ears and adjacent poll region are sensitive. Pressure on the aural cartilages, the caudal auricular muscles, or neurovascular structures may cause signs of head tossing or shaking, an unsteady head carriage, unsteady contact with the bit, holding the head behind or ahead of the vertical, twisting at the poll, avoiding a consistent contact with the bit as well as more generalized signs of discomfort or resistance.[12] Note, however, that these signs of pain are not pathognomonic for poor bridle fit or use.

Things to consider around the ears:

- Many bridles have a cut out area for the ears, which is beneficial as long as the cut out is in the correct place for the individual horse (**Fig. 8**).
- If the browband is too short, it pulls the headpiece forward against the back of the ears; a too long browband is preferable over a too short browband.
- Some headpieces are designed to avoid pressure over the dorsal midline of the poll; however, pressure relief in one location inevitably increases pressure elsewhere. In this case, pressure increases on either side of the poll in the area behind the ears, which some horses find particularly painful.
- Research using a small pressure mat[13] indicated high pressure where the browband joins the headpiece. Cushioned pads on the headpiece provided clearance at the base of and ventral to the ear (**Fig. 9**).

Fig. 8. Headpiece of a bridle specifically designed to contour around the caudal aspect of the external ear (*yellow arrows*) to relieve pressure applied on the back of the ears.

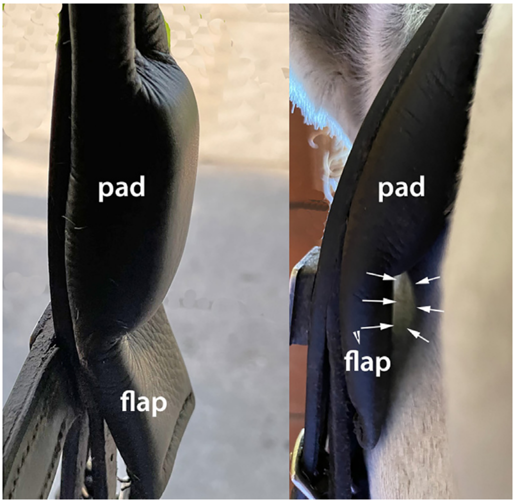

Fig. 9. Left: Caudal view of a cheekpiece of a bridle with an added foam pad and attached flap; right: the added padding lifts the cheekpiece away from the horse's face to relieve pressure in the area outlined by white arrows.

When using a leverage bit, conventional wisdom is that rein tension rotates the lower shank backward while the upper shank rotates forward and applies pressure via the cheekpiece and headpiece to the poll. However, the amount of poll pressure is actually considerably less than expected due to the elasticity of the horse's lips allowing the fulcrum to move.[14]

The cheekpiece should lie ventral to the facial crest, which means that the front part of the noseband must be long enough to allow for proper cheekpiece placement, which can be difficult in breeds with a prominent nasal region. Areas in which the bones of the skull are located superficially are vulnerable to bridle pressure. The buckles on the bridle should overly soft tissues, such as the masseter muscle rather than bones, particularly around the temporomandibular joint.

The throatlatch is intended to prevent the bridle falling off over the ears but it should not be tight enough to put excessive pressure on the ventral throat area when the poll is flexed. Some bridles use a jowl strap in addition to, or instead of, a throatlatch, which is more effective both in keeping the bridle on the horse's head and in preventing the cheekpiece from moving dorsally toward the facial crest (see Fig. 7).

The noseband is undoubtedly the most controversial part of the bridle. It is suspended from a strap that passes over the top of the head, or sometimes incorporated as part of the headpiece. One or 2 straps encircle the nose and mouth. A correctly adjusted noseband is used as an aid to help teach the horse to accept the bit without opening the mouth excessively, by allowing the jaws to separate by a small amount before the noseband tightens and applies supportive pressure to the muzzle region. When the mouth closes, a properly tensioned noseband should immediately release pressure, so it acts by negative reinforcement.

Some nosebands have a single strap and others, such as the flash and Fig. 8 nosebands, have 2 straps going around the horse's face. When the noseband has a single strap fitted 1 to 2 cm below the facial crest, it may be classified as a cavesson or a Swedish (crank) noseband. The Swedish noseband is distinguished by having a double strap arrangement under the jaw that incorporates a padded chin piece to cushion the edges of the mandibles. It also usually has a well-padded area over the dorsum of the nose. A drop noseband has a single strap but is fitted lower on the face, just above the maxillary notch, and its ventral strap is fitted below the mouthpiece of the bit.

Lesions at the lip commissures have been related to tightness of the upper noseband strap, which is the one placed higher on the horse's head, and having a looser upper strap is significantly associated with fewer commissural lesions.[15] Without a noseband, however, the prevalence of lesions at the lip commissures increased 2.6 times compared with the loosest noseband category.[15] Neither the presence nor tightness of a lower noseband (flash, see **Fig. 8**, Micklem) affected the prevalence of lesions at the lip commissures[15] probably because the lower strap crosses the interdental space where teeth are absent.

When the noseband is overtightened, the areas sustaining the highest pressures are the lateral edges of the nasal bones and the underside of the mandible,[16] that is, the areas where the noseband runs over bony prominences.[13,16,17] An ingenious solution is a noseband with a foam pad over the bridge of the horse's nose that completely off loads the edges of the nasal bones[13] (**Fig. 10**).

Some riders overtighten the noseband to keep the horse's mouth closed, especially in sports that penalize the horse for opening its mouth or exteriorizing their tongue. Horses that habitually open their mouths when ridden are likely to be suffering intraoral pain or discomfort. These horses should be examined while wearing the bridle and noseband adjusted in the typical manner to evaluate whether the bridle fits and is adjusted correctly. The horse and rider may also be observed during ridden work to evaluate the rider's position and use of the reins and the horse's response, including resistant behaviors. After removing the bit and bridle, a perioral and intraoral examination should be performed to examine the lips, oral commissures, buccal mucosa, the bars, the tongue, and the hard palate for the presence of lesions or painful tissues. The dental arcades should be examined for overgrowths on the rostral cheek teeth and for the presence of wolf teeth and whether they are erupted or not. If a potentially painful oral lesion is found, the underlying cause should, if possible, be identified, and the lesion should be treated and allowed to heal before resuming exercise with the offending bit or bridle.

BITS

Perhaps, more than any other item of tack, new bits appear frequently on the market that incorporate reported changes in design or materials. The effects of the bit within

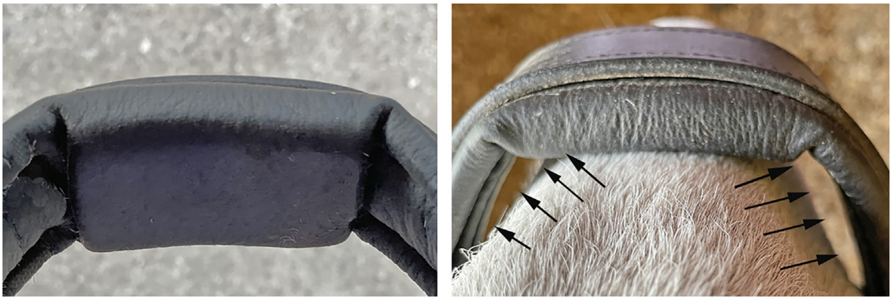

Fig. 10. Left: Inner surface of noseband showing a soft foam pad applied on the dorsal midline; right: the pad completely off-loads the left and right edges of the nasal bones (*black arrows*).

the oral cavity are difficult to evaluate visually but radiographic and fluoroscopic studies have provided information describing bit orientation and contact with intraoral structures.[18–21] When rein tension is applied, the orientation of the bit within the mouth does not change[22] but it may move relative to oral structures leading to increased or decreased pressure.

A bit consists of a mouthpiece that may be unjointed or include one or more joints. The mouthpiece attaches via rings on its lateral sides to the cheekpieces of the bridle and to the reins. A snaffle bit is a nonleverage bit with the cheekpiece and the rein attaching to the same ring. An exception to this is the hanging cheek (Baucher) snaffle in which the cheekpiece attaches above the rein, perhaps allowing a small amount of leverage. In a curb bit, the rein attaches to a shank (cheek) below the level of the mouthpiece and the cheekpiece attaches to a shorter shank above the mouthpiece. Rein tension may have a leverage effect by rotating the upper shank forward, increasing tension in the cheekpiece, and applying pressure to the poll.

The bit is interposed between the tongue and hard palate and, because the oral cavity is a virtual space,[18] the bit is accommodated within the malleable, muscular tissue of the tongue that molds around it.[18] When the horse's lips are parted, the tongue bulges out between the bars at the interdental space and acts as a cushion to protect the bars from bit pressure. The tongue can also push against the mouthpiece of the bit to relieve pressure.

The cheekpieces are adjusted so that the bit fits into the corners of the lips usually with a single fold or wrinkle of the lips. The commissures of the lips are the most common site of bit-related injuries, which include bruises or ulcers (**Fig. 11**) at the commissures and on the buccal mucosa. Horses ridden with a snaffle bit have 8 times higher risk for developing buccal lesions.[23]

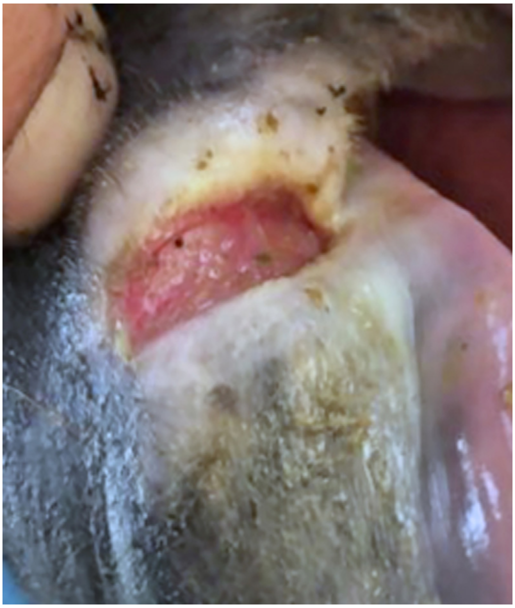

Fig. 11. Typical ulcer located in the lip commissure due to excessive bit pressure. (Photo courtesy of Dr. Mette Uldahl.)

Uldahl and colleagues[24] described in detail a protocol for analyzing and categorizing lesions of the oral commissures, including potentially pathologic changes in pigmentation, roughness, erosions, contusion, and scars. Applying this classification to horses at a precompetition evaluation[25], about 8% of horses examined had commissural ulcers indicating current damage and about 30% had scars indicating previous damage. Most types of lesions were bilateral (ulcers, scars, fissures, bruises). Although very few horses had isolated lesions on the bars, those horses with commissural erosions, bruises, and ulcers had similar lesions on the bars. Dental overgrowths (hooks, sharp enamel points) were usually bilateral but not related to mucosal ulcers or erosion or contusion at the lip commissures. However, ulcers around the lip commisures were associated with scarring and depigmentation in that area, which are evidence of previous bit damage. There was a clear relationship between the presence of current and previous perioral and intraoral damage indicating the ongoing nature of poor bit fit or use problems.

Studies in several sports have reported oral lesions in horses immediately after competition:

- In 3143 dressage horses, show jumpers, eventers, and endurance horses, 9% had oral lesions or blood at the lip commissures.[15]
  - Lesions increased with level of competition but did not differ between bit types or bitless bridles
  - A looser upper noseband had reduced risk of oral lesions but the absence of a cavesson increased the risk of commissural lesions 2 times compared with the loosest noseband
- Fifty-two percent of eventers had acute oral lesions immediately after cross-country.[26]
- Eighty-four percent of trotters had acute oral lesions after racing.[27]
  - Two percent were bleeding
  - Five percent had blood on the bit but not visible externally
- Racehorses wearing snaffle bits had a high prevalence of severe injuries of the lip commissures and bone spurs on the bars.[28]
- Polo ponies wearing gag bits had bone spurs on the bars and some had tongue ulcerations.[28]

Some horses play with the bit excessively using their tongue to raise the mouthpiece and grasp it between the premolars,[19] especially when using jointed bits. Unjointed mouthpieces lie higher on the tongue (**Fig. 12**) and have less intraoral mobility than jointed bits, which hang with the joint(s) lower on the tongue, especially if the mouthpiece is too wide or the cheekpieces are too long.[19] In these cases, check the following:

- The width of the bit should be about 1 cm wider than the distance between the lip commissures.
- The bit should be adjusted to fit into the commissures of the lips with a small wrinkle present in the skin.

In double-jointed bits, the width of the central link determines the position of the joints relative to the bars (**Fig. 13**). If the central link is narrow, the joints are less likely to be directly over the bars. If the joints are directly over the bars, there is the potential for the loops of the joint to press against the bars. Some bit designs are intended to be inserted into the horse's mouth in a specific orientation to ensure the loops lie parallel to the bars. If these bits are negligently or deliberately reversed, the loops of the joint will be perpendicular to the bars, which increase the potential for pain and injury.

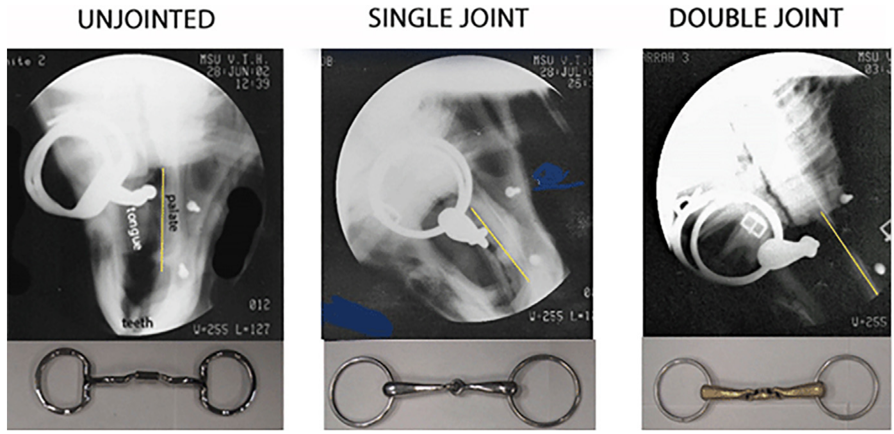

Fig. 12. Lateral radiographs of unjointed (*left*), single-jointed (*center*), and double-jointed (*right*) snaffle bits. Dorsal to the right. Yellow line shows position of the hard palate. Note how far the bits hang down on the tongue in each image, which can be assessed by the distance from the most rostral part of the bit to the rostral edge of the first cheek tooth. Note also the proximity of the 3 bits to the line representing the hard palate.

For many years, it was thought that thicker mouthpieces were kinder because they distributed pressure over a larger area but it is now recognized that bits of medium diameter (14–17 mm measured at the outer edge) are associated with fewer lesions.[26] Large diameter bits are too big to fit into the limited space between the bars, whereas thin bits are more likely to localize pressure and cause damage.

The bit type affects the lesion type. Bruises, ulcers, and bone spurs on the bars are usually associated with unjointed (curb) bits, with horses ridden in ported curb bits

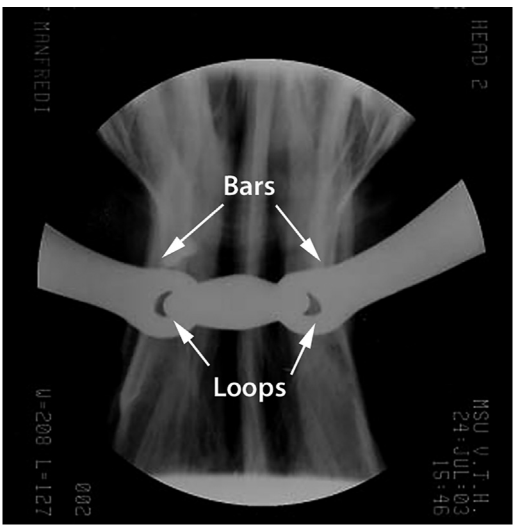

Fig. 13. Dorsoventral radiograph showing the relationship between the mouthpiece of a double-jointed bit and the bars of the mandible. Note the canons of the mouthpiece extending laterally on either side of the bars. The bars are separated from the lip commissures by a distance of several centimetres[31] due to the intervening fleshy cheeks and narrowing of the mandible in this area.

being 75 times more likely to have lesions on the bars.[23] It has been suggested that curb bits with a large, backward-sloping tongue relief or port are most likely to cause these lesions. When rein tension rotates the lower shank backward, the port rotates forward against the palate and the mouthpiece presses down on the bars. If the port is angled forward relative to the shanks, it does not impinge on the hard palate. A large tongue relief or port allows the tongue to bulge into the elevation but makes it more difficult for the horse to push against the bit to reduce pressure. Bit-related damage to the tongue is infrequent and is usually associated with severe damage to the bars caused by an unjointed bit.

The hard palate seems particularly sensitive to pressure. There are intraindividual differences between horses in the shape (flat or arched), width (34–50 mm), and height (5–14 mm) of the palate,[29] and these are likely to influence the risk of bit contact. Palate contact is usually from the loops of a jointed snaffle or from a port that is oriented backward (caudally) relative to the shanks. When rein tension rotates the port into the palatine tissues, horses respond by opening the mouth to reduce palate pressure.[19] Riders may respond by overtightening the noseband.

Bit-associated lesions bleed infrequently, although blood within the mouth is more common than externally visible blood.[27] Even in the absence of blood, oral ulcers and bruises are likely painful and are reason to recommend avoiding the use of a bit until the lesion has healed.

Alloys of various metals are used in bits. Oxidation of copper is thought to induce salivation. Titanium is lighter than steel and highly resistant to mechanical damage from the teeth[30] and, although it can cause contact allergy in people, this has not been reported in horses. Nickel causes allergic contact dermatitis in people but the nickel release rate from bits is so small that allergic reactions seem unlikely. However, vesicles on the equine oral mucosae have been reported in response to nickel contact.[30] A current trend is the use of sweet iron bits that develop a blue color after heating to around 300°C. Contact with air and humidity rust the surface giving it a sweet taste that may encourage salivation. The iron released by these bits is below the toxicity level for horses.[30]

CLINICS CARE POINTS

- Saddle fit is not easy to evaluate in the standing horse: it is difficult to assess areas that are hidden from view and back shape changes continuously during locomotion.
- Pay attention to indicators of discomfort that may be related to poorly fitting tack including the horse's facial expression, restricted limb movements and conflict behaviors.
- Adaptations in back shape occur over time in response to the amount and type of exercise; saddle fit needs to be checked regularly and adjusted as necessary to allow the horse to function optimally.
- Innovative equipment does not always function as expected, evaluate on an individual basis.
- If you suspect a horse is suffering from pain related to the bit or bridle, evaluate fit with the tack adjusted in the customary manner. A qualified bit and bridle fitter can be consulted if you are not confident in this area.

DISCLOSURE

Neither of the authors declares any commercial or financial conflicts of interest.

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