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Equine Dentistry: Safety Considerations for Practitioners

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Motorized instruments and profound sedation are invaluable to the practice of equine dentistry. They do, however, present multiple safety challenges. It is essential to understand and mitigate these hazards for the welfare of veterinarians, assistants, and patients. This manuscript explains effective and safe restraint and positioning of the horse for dentistry. It also makes practical recommendations that will help protect the operator and assistants from electrocution, hearing damage, pulmonary illness, and ocular insults.

KEYWORDS sedation, restraint, electrical safety, ergonomics, safety glasses, ear protection, facial masks, respirators

As equine dentistry has evolved, practitioners have gained access to education, medications, and instrumentation that have dramatically increased the effectiveness and ease with which dentistry can be performed. A plethora of motorized instruments has replaced many hand-operated instruments. Some are operated by batteries or gasoline generators, but most are electrical. The introduction of butorphanol tartrate and detomidine hydrochloride into sedation protocols has made the placement of a full mouth speculum under sedation both feasible and commonplace.[1] Comprehensive examination of the mouth and correction of dental abnormalities using sedation, a full mouth speculum, and motorized instruments (often in combination with hand-operated instruments) is now considered the gold standard in dentistry.

The practice of dentistry has always involved risk to practitioners and handlers.[2] The introduction of deeper sedation and electrical instrumentation has added potential new risks as well. While wearing a full mouth speculum, a horse can throw its head and injure those nearby. Fractious or heavily sedated animals can strike, trample, or fall on practitioners and handlers. Practitioners are particularly vulnerable to severe traumatic injury, since they stand in front of the horse. Other potential hazards include: repetitive use injuries, electric shock, pulmonary or ocular insult from tooth particle aerosolization, and hearing damage.

This paper will describe safety equipment and techniques necessary for the safe practice of equine dentistry. All recommendations satisfy Federal Occupational Safety and Health Administration (OSHA) requirements.

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Materials and Methods

The following safety recommendations are mainly derived from two sources: (1) on-site evaluation of the author's dental practice by the Washington State Department of Labor and Industries, in compliance with the Washington Industrial Safety and Health Act (WISHA). WISHA standards always meet or exceed OSHA standards; and (2) personal experience of the author. Recommendations include: providing safe and effective restraint and sedation, using electrical equipment in a manner that minimizes the risk of electric shock, using proper ergonomics, reducing pulmonary and ocular exposure to aerosolized tooth dust, and keeping noise production at low enough levels to prevent hearing loss.

Sedation and Restraint

The work environment should be as safe as possible. The ceiling should be high enough to prevent injury to the horse if it rears. Rubber padding or shavings on a level floor are ideal. Cement surfaces are slippery when wet and too hard to cushion falls. Although many practitioners work in clients' barns satisfactorily, some have clients haul to their practice or another facility that is ideally equipped. Some have adapted horse trailers into a dental facility.[2]

Optimal sedation/analgesia makes the patient unaware of external stimuli without excessive destabilization. There are several sedation protocols that can be used successfully. Most involve the intravenous administration of one or more of the following: the alpha-2 agonists detomidine hydrochloride and/or xylazine hydrochloride, and, when indicated, the addition of butorphanol tartrate, and/or diazepam. The addition of butorphanol tartrate after the administration of an alpha-agonist may produce a quieter patient. Butorphanol tartrate must be used judiciously, however, since it can cause

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the horse to walk or stumble forward. The author usually uses an initial dose of 15 to 20 μg/kg detomidine HCL, IV followed immediately by 7 to 10 μg/kg of butorphanol tartrate, IV.

Waiting at least 5 minutes after the administration of an alpha-agonist before starting procedures will maximize the intensity of sedation and allow the horse to stabilize its posture after the typical initial period of mild ataxia. Some practitioners add diazepam to the protocol to still the tongue, but it can accentuate ataxia and should be used with care. The author waits at least 15 minutes after initial sedation to add diazepam, uses it only if necessary, and does not exceed a dosage of 4 μg/kg, IV. Sedatives can be dosed again as needed during the procedure. Small doses of detomidine HCL (4-6 μg/kg, IV q 15-30 minutes) can be administered as needed to keep the horse quiet. Alternatively, the practitioner can give 0.3 to 0.5 mg/kg xylazine HCL, IV. The procedure can be resumed 2-3 minutes after this additional dose. It is important to note that draft breeds may need half the amount of sedation by weight of other breeds.[3] Mules may need to have up to 50% more sedative by weight than a light horse.[4]

Everyone involved in placing a mouth speculum is susceptible to injury. Placement should not be attempted until the horse is adequately sedated. Ideally one person should be on each side of the head placing the speculum. Each person should position himself at arm's length from the head in case the horse suddenly moves. A stand, hanging ring, or dental halter are common lifts that are used to hold the head in position. The author uses a padded stand with lateral bars that help protect people from injury if the horse swings or shakes its head (Fig. 1). A team approach is best when elevating the head onto the stand, since it is very heavy.

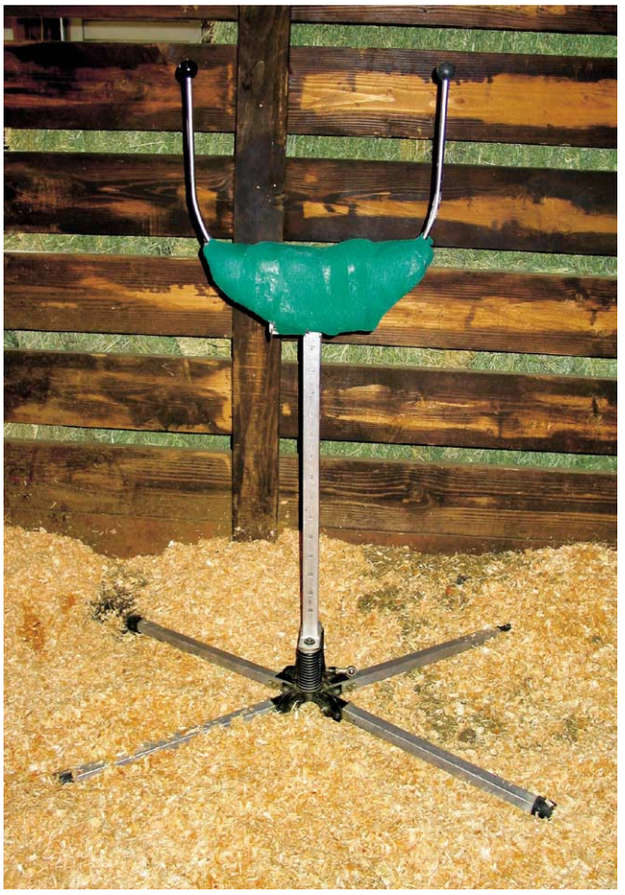

Figure 1 Freestanding head stand with lateral bars (Equi-dent Technologies, Reno, NV).

Ergonomics

Assuming awkward postures, using high force, repetitive movements, and being exposed to hand/arm vibration can all lead to injury. The operator should move the area of interest to eye level by raising or lowering the horse's head. Bending at the knees instead of tilting the neck to the side and keeping stomach muscles taught will help prevent back and neck strain. Instruments should be held as closely to the body as possible to increase control and prevent fatigue. Wrists should be kept straight (Fig. 2). Repetitive motions can be minimized by keeping burrs, grinding disks, and blades sharp. Some pneumatic instruments cause excessive hand vibration; it is advisable to use instruments at a teaching laboratory or on a trial basis before purchasing. The operator will benefit from maintaining a reasonable level of physical fitness. There are several resources available that address fitness, stretching and proper ergonomics.[5-7]

Electrical Hazards

A ground fault interrupter (GFI), also called a ground fault circuit interrupter (GFCI), should be used in all outlets, even if the outlet itself has a GFI (Fig. 3). It should always be dry and sheltered from rain, and it should trip at a maximum of 5 mA of overload to prevent electrical shock. The GFI should be tested before every use. It is important to note that a surge protector will prevent instruments from a damaging electrical surge, but it is not necessarily equipped with a GFI and therefore may not protect the operator from electric shock.

The work should be as dry as possible. The mouth should be rinsed into a bucket, and any spills should be wiped up. Floor pedals should be placed in a heavy plastic resealable storage bag to minimize the risk of water entering the connections.

A heavy duty outdoor-rated extension cord (at least 12 gauge) should be used, and it should be unwound to a continuous length. All power strips should be rated for outdoor use as well. All electrical cords, connectors and instruments should be in excellent condition. Cords should be hung up off the floor in order to prevent tripping and exposure to moisture. Portable bridle hooks work well for this. After use, the extension cord should be wound up without twisting it.

It is important to read instructions and safety precautions for each electrical instrument. All instruments should be elevated on a table or hook to keep them from getting wet. Metal jewelry should not be worn.

Working outside in the open with electricity can be hazardous, and should only be attempted if the ground is dry and the weather is fair. Alternatively, the operator can use instruments that run on batteries.

Hearing Protection

Consultants from the Washington State Department of Labor and Industries measured noise levels on site by clipping an

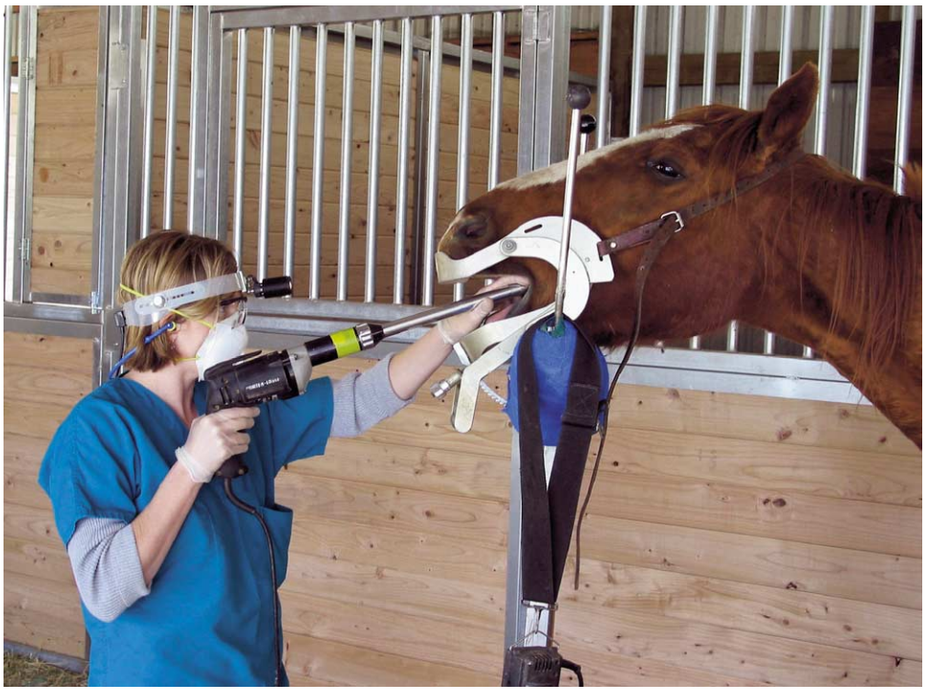

Figure 2 Proper ergonomics with safety equipment in use. Operator is using a rotating disc grinder (Power Float, D&B Equine Enterprises, Inc., Calgary, Alberta, Canada). The use of examination gloves protects the operator and the patient from excessive exposure to infectious organisms.

audio dosimeter near the ear of the author over an 8-hour workday. The instruments evaluated were an electrical rotary disk grinding wheel and a 1/5 horsepower drill suspended from the dental stand approximately 2 feet from the operator's ear. Over this period, the average exposure was 71.9 decibels, well below the OSHA Permissible Exposure Limit of 85 decibels. Due to the variation in types of instruments, as well as the variable speed and duration of use in different situations, OSHA recommends ear protection when operating electrical tools of any type. Muffs or plugs are acceptable (Fig. 4), and the higher the NRR (noise reduction rating), the more protective they are.

The most accurate way to measure noise levels is for the operator to wear an audio dosimeter over an average workday. Practitioners with concerns about noise levels in the workplace should consult their state labor and industries department for an evaluation.

Respiratory Protection

Motorized instruments produce tooth dust and aerosolized organisms. The actual particle size of equine tooth dust is currently unknown. Until particle size has been measured, it is prudent to be cautious and wear a mask or respirator that is as protective as possible. Most hardware stores carry masks with an OSHA rating of N-95 (Fig. 4), which is protective against 95% of aerosolized particles. It is composed of a thick cotton-like barrier—not a thin barrier like a surgical mask, which would be inadequate. It is very important that the face

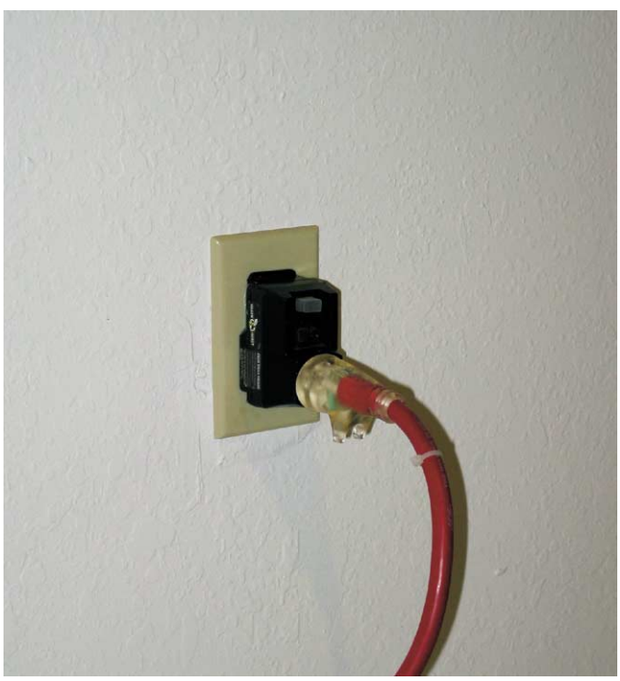

Figure 3 Ground fault interrupter.

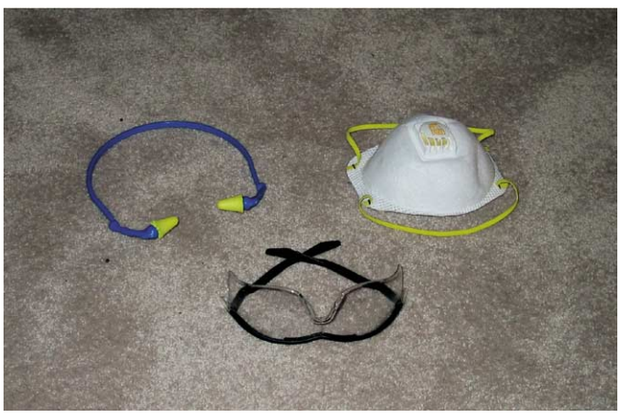

Figure 4 Back row (left to right) insert type hearing protection, n-95 respiratory mask. Front row –ocular safety glasses.

seal be as tight as possible. Beards, beard stubble, or side burns may interfere with this. Both straps should be placed around the head, and the nosepiece should be formed over the shape of the wearer's nose.

For more complete assurance against inhaled particulates, a P-100 respirator can be used. It is larger and heavier, but some models have a fairly low profile. These can be purchased in specialty safety stores. It gives the best assurance against inhalation of particulates, and may be the best choice until the actual particle size of tooth dust has been evaluated. Any assisting personnel should also wear respiratory protection.

Vacuum suction and/or irrigation dramatically reduce tooth dust, but do not eliminate it. It is still necessary to wear a mask. Ideally, as in human dentistry, irrigation, vacuum suction, and a mask should be used simultaneously.

Eye Protection

Eye protection is necessary at all times while using motorized dental instruments. Goggles are not necessary unless the operator is working with material that is caustic, corrosive, or toxic. Quality safety glasses with side shields are sufficient (Fig. 4). Assistants should wear safety glasses as well. OSHA requires eye protection for any procedure that produces aerosolized particulates.

Results and Discussion

This author received many valuable safety recommendations from the on-site consultation by the Washington State Department of Labor and Industries. Practitioners who want to assure themselves that they are meeting all minimum OSHA and individual state safety requirements should consult with the appropriate individuals at the state level. Although it will require some time commitment and possibly some changes in technique, instrumentation, and/or safety equipment to reach compliance, it will ensure the safest operation of a dental practice.

Acknowledgments

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