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A photographic methodology for analysing bit position under rein tension

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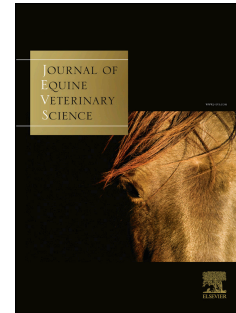
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A photographic methodology for analysing bit position under rein tension**Authors:** Caroline C. Benoist^{1*} and Graham H. Cross²¹ NS Academy, Momentum, 30 Ellerbeck Court, Stokesley TS9 5PT UK² University of Durham, Department of Physics, South Road, Durham DH1 3LE, UK***Corresponding author.**E-mail address: caroline.benoist@gmail.com**Abstract**

Bits are a common and invasive piece of equipment used in equestrian sports. A bit should be carefully chosen to suit the individual horse according to the pressure points it is willing to accept. Bit pressure is poorly understood due to a lack of accessible research instruments. The objective of this study was to describe a method to estimate pressure points from the bit on the tongue without the need for radiographs. The method employs photographic images of horses under static rein tension. Using design features on the bit, the angle at which these features press into the tongue were calculated. Ten riding school horses wearing a snaffle bridle without a noseband, were used to measure the degree to which a bit rotates under 2 kg of static rein tension for a: Turtle Top snaffle bit, French Link snaffle bit, HS single-jointed snaffle bit and ported Weymouth bit. Six dressage and eventing horses were used to measure the effect of rein tension, in 0.5 kg increments, on the degree of rotation of the bit. The bit rotated, but not significantly ($P > 0.008$), over the rein tensions used (up to 2kg). The reliability of the proposed method was confirmed by comparing anatomical reference lines in photographs with those in radiographs. The findings provide a reliable estimate to determine pressure points from a bit on the tongue, under rein tension without the need for invasive techniques and in the absence of technologically adequate equipment.

Keywords: Radiography, Rein Tension, Horse, Bit, Tongue, Pressure**1. Introduction**

Controlling the ridden horse's speed and direction is commonly achieved by using a bit inserted into the horse's oral cavity. Reins are attached to the cheeks of the bit, allowing the rider to apply pressure to various points on the horse's head, in addition to the oral tissues [1–3]. The horse learns to respond to the release of pressure by the rider who does so to acknowledge a correct response from the horse. This form of learning, known as negative reinforcement, is commonly used for controlling horses [4].

The snaffle, Pelham and curb, or Weymouth, are the three most common types of bits used in riding and are classified according to the cheeks, mouthpiece, and mechanism of action [5]. The snaffle bit can have an unjointed, single-, double- or multi-jointed mouthpiece with either loose, or fixed rings on either end to which the cheekpieces of the bridle and the reins attach. However, a large variety of bit cheeks can be attached to this type of mouthpiece that can add or negate pressure on the area

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