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Guest Editorial

Saddles and seats in animal and human sports: Where is your *smart, wearable, real-time* feedback?

In human 'saddle sports', such as cycling or rowing, there is ample evidence that type and fit of the saddle or seat are closely related to both injury occurrence and performance (Van Soest and Hofmijster, 2009). For optimal performance, the human athlete should be optimally fitted to its instrument, be it the bicycle or the boat. This is no different in equestrian sports, where the saddle should optimally fit to the human athlete, and the fit of the saddle to the 'animal athlete' should be equally optimal (Back, 2013).

Although in recent years a wealth of information became available to improve the performance of the equine athlete, much information about the saddle and its fit during locomotion is lacking at this time. A good fit between rider, saddle and horse is likely to facilitate optimal 'between body' communication. This is particularly relevant, as body communication and equine performance appear to be closely related (Back, 2013).

In their recent review *Saddles and girths: What is new?*, Dyson and Greve (2015) point out that too many riders do not regularly assess their saddle fit. Since horseback dimensions can change considerably over time, saddle fit should be assessed frequently. Ideally, horses should be ridden with individual, purpose-fitted saddles, rather than the same saddle being used on several horses, as to date is often the case. Dyson and Greve (2015) subsequently describe the types of saddle fit, the relationship between saddle fit and horse and rider health, the potential effects on equine epaxial muscle development of an ill-fitting saddle, the changes in thoracolumbar dimensions with exercise, the rider effects on the horse, saddle slip, girths, saddle flocking, treeless saddles, racing saddles, pads, numnahs and riser pads; in fact everything you always wanted to know, but were afraid to ask about saddles and their fit.

It follows that veterinary professionals need heightened awareness of the role of saddle fit on equine performance and welfare. Modern 'smart' sensor technologies, such as inertial measurement units (IMU), may help select the correct equipment (Clayton and Schamhardt, 2013). Such sensors can be attached to horses and riders, e.g. to the limbs and other specific anatomical locations on the body of the horse. The current challenge would be to display these complex, high frequency (1000 Hz) sensor data online as simple easily interpretable performance parameters in real-time for riders, as well as their supporting team. Head up displays (e.g. Google Glass) could be used to provide the rider with relevant information without any negative interference with the main task (i.e. hands-free information while riding the horse; Kooijman et al., 2014). In that respect, it might be interesting to note that currently the authors of this editorial are developing such technology for both rowing and horse riding, and that athletes in both sports are currently obtaining their first user experiences (Figs. 1a, b). For the equestrian athlete and the supporting team, this setup could aid in the early recognition of locomotor disturbances for both the clinical diagnosis of the negative effects of an ill-fitting saddle as well as the evaluation of the positive effects of a specially designed saddle for extra locomotor comfort and a higher level of sports performance.

In line with this development, Dyson and Greve (2015) conclude that there is a growing body of evidence demonstrating that ill-fitting saddles not only induce pain and thus compromise equine performance, but may also impair epaxial muscle development and thus equine locomotor functionality, resulting in deleterious consequences for horse and rider performance in the long term. Hence, there is a clear need for better education and support for riders and trainers concerning saddle and numnah fit, and for more frequent saddle fit assessments by appropriately trained professionals. The relatively new profession of the 'saddle fitter' seems to be a valuable first step into this direction, soon followed by the 'bit fitter'. We would like to add that modern sensor technologies, data interpretation algorithms and real-time display technologies are likely to aid in this awareness.

In conclusion, Dyson and Greve (2015) provide an excellent overview of the current state of saddle fit and its effects on horse and rider, which are key elements to be evaluated every day to ensure safe and careful horse riding. Sophisticated, *smart*, *wearable*, *real-time* feedback might help find the correct saddle fit, and benefit rider and horse interaction in the not-so-distant-future.

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Fig. 1. (a) A rower benefitting from Google Glass feedback. (b) A rider benefitting from Google Glass feedback. Research support by STW Demonstrator Grant 14026.

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