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# Lever Bits – Make the Right Choice

## Lever bits are better than their reputation suggests

The research results presented in the third part of the series prove without a doubt, that the so-called lever bits offer a clever solution to improve the communication with the horse, and they are no less horse-friendly than snaffle bits. Just because something is effective, that does not mean that it has to be severe. The rein tension is transmitted to several communication points on the horse's head, what helps the horse to understand the aids. No amplification of the force applied to the rein could be observed – and why should only the sensitive area of the tongue be exploited to communicate with the horse, just because someone has invented that 3500 years ago? Not only for kids, an appropriately chosen lever bit is always a better option to communicate effectively, than aggressively pulling the reins or using really severe mouthpieces as pictured.

## Horse-friendly tools for hacking, show jumping and cross country

Considering the broad variety of bits on available on the market, making the right choice will never be easy, but we can at least deduct some „rules of thumb" from the research results:

Bits with a "loose lever" (see picture) offer a mild support. Their action is retarded and only sets in after the rein has been shortened by a certain amount, furthermore it has impulse character. They offer different options to fix the rein, thus the impact can be varied individually taking into account the situation and the current mood of the horse. They are legal in most countries and internationally for show jumping and cross-country competitions, and are a universal tool for training and pleasure riding. The Beval ring (fig. 2 topmost) is a great help for beginners who do not find it easy to learn how to get the horse on contact.

In Germany, Pelhams used with a curb chain are the only lever bits legal in lower show jumping and cross-country classes. They redirect some of the rein tension to the chin groove and the poll and have a mild but constant effect.

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They relieve some of the pressure on the mouthpiece compared to snaffle bits. Nevertheless it is essential to choose an anatomically suitable mouthpiece, because the rein tension magnitude observed in canter, especially in tight turns, can get quite high (up to 7kg have been recorded by the Bluetooth-Equipment) There are also Pelhams with bar mouthpieces (picture above), but the rider should be aware that not every bar is suited to the mouth anatomy. Furthermore, these types of bits are easily tilted if the rein is applied one-sidedly. Therefore, they should be reserved for experienced riders.

Gag bits act as class 1-pulleys and allow a direct transmission of the rein tension to the poll, the bit (resting on tongue and lips) providing the floating fulcrum. They are a good help for horses, which try to evade the rein by raising the head in critical situations, if they tolerate some pressure on the tongue. Gags are typically used for playing Polo. Experienced riders are able to dose the impact carefully. It is optional to fix a second rein to the snaffle ring (see picture). This variation is popular if the horse is generally easy, but winds up in certain situations like hunting or in the show jumping arena.

Some information about the Baucher Snaffle shall also be included, though strictly speaking, this is no lever bit, neither due to the construction nor to the effect, which is a definite relief of the poll. This does not really explain the evidently positive action in case the horse tends to be constantly above the rein, but justifies its use also for pleasure riders especially with horses of heavy breeds and little freedom in the cheeks.

## Weymouths – for perfect communication in dressage

If hitherto you have formed the impression that lever bits are not too risky if they are used as intended in pleasure riding, show jumping or cross country; the use of Weymouths is a different business: They have a bar mouthpiece and the reins are always attached to the far end of the shank. The problem does not arise from not the possible lever action on the poll: It has been explained in part 3, that not more than ¼ of the rein tension is transmitted to the poll. Actually, it results from the fact, that the fixed mouthpiece bar can accidentally be tilted if the rein is applied one-sidedly. The effect of this gets more severe if the shanks are longer.

Weymouth type bits have originally been invented by medieval knights, who had only one hand free to take the reins (the other one carrying a sword or lance), and wanted to be able to reliably stop their often not too well schooled mounts. This is done by taking up (shortening) both reins simultaneously, what results in raising the shanks. It is possible to steer the horse when using a bit of this construction by pulling both reins to the same side. That has been sufficient in medieval battles or tournaments, but not for the complicated movements of modern dressage competitions. For this purpose, the Weymouth is complemented with a snaffle bit (bridoon). The double bridles can either be “shared” by both hands or 3:1, taking both Weymouth bridles in one hand. The discussion about the merits of each method may benefit from taking into account these physical facts.

Especially show jumpers using Pelhams with a bar mouthpiece should be aware of the danger of tilting the bit inadvertently.

When choosing a Weymouth, there are three aspects to consider:

## Short or long shanks?

This seems to be the first consideration of most Weymouth novices. According to the FEI rules, a lower shank length between 5 and 10cm is allowed; the lower shanks may not be shorter than the upper shanks. The so-called „baby Weymouths“ sport upper and lower shanks in nearly equal length, intending to transmit rein tension to poll and curb chain, without causing amplification of the rein force due to a lever effect (the relevant force diagram is depicted in fig. 2 of article no. 3). As our experiments have proved, only a fraction of the rein tension is transmitted to the poll, thus the effect of the shank length is actually not as prominent as traditionally believed.

On the other hand, some basic mathematical facts reveal that longer shanks actually allow a milder action than shorter ones. The angle which is caused when the reins are shortened by a certain amount is smaller, if the shanks are longer, thus allowing a more subtle interaction (for details, see Technical Information below). This would definitely be a reason to prefer longer shanks for novice riders; on the other hand, the danger to cause irritation by tilting the bit is also more significant. The personal good or weak points of horse and rider should be taken into account, and of course the looks...

## The shape of the mouthpiece bar

should be the foremost consideration when fitting a Weymouth bit: Apart from the thickness, the shape and direction of the port is very important. Mouthpiece bars with next to no port were originally invented in France; a very prominent, nearly rectangular, bar is a typical German design. Many people believe that the port is meant to accommodate the tongue, which is actually much too big and fleshy to allow this. When the Weymouth is used with the correct shank angle of 45°, the common forward tilted port is pressing on

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the tongue. Horses with “long smiles” usually tolerate that, as the port is resting on the sweet spot in the centre of the tongue. Horses with short smiles (e.g. Thoroughbreds or Spanish breeds) do not find it comfortable; in their mouth, the port is affecting the sensitive distal areas of the tongue. This can be taken into account in the design of mouthpieces: The picture shows three different variations of a mild port, which is tilted in different angles: Forward for a long smile (left picture), upright (centre), and backward to accommodate a short smile (picture on the right).

## A suitable bridoon

The first consideration usually concerns the thickness, which is of course an obvious aspect if two mouthpieces together are used: How much metal can the horse’s mouth accommodate? The traditional solution is to choose a thin bridoon (minimum thickness 10mm), as the Weymouth designs available on the market used to be rather on the clumsy side. As we now know, the rein tension applied through the Weymouth is partly diverted from the tongue to other points, and an anatomically well adapted bar offers a wide bearing space to distribute the remaining pressure, thus a thinner bar is the preferable option (required minimum thickness 12mm)Then a thicker bridoon can be used with it. This acts generally in the same way as the single snaffle bit, and should be chosen following the same criteria, which have been explained in part 2. The best idea is to take the same mouthpiece shape for snaffle and bridoon; it is even possible to use the normal snaffle bit. The diameter of the rings is not specified in the rules, neither a maximum mouthpiece thickness (any more). Both mouthpieces together should not be more than 30mm thick, as the room between the lower and upper bars is limited, and in some cases also the length of the diastema (area between the molars and incisors) if canine teeth are present.

The correct width of the Weymouth is determined following the criteria for fixed cheeks; the shanks may snuggle up to the lips. Thus the Weymouth will usually be a little bit smaller than the loose ring bridoon (in same cases even a lot smaller, as some horse’s head gets slimmer towards the muzzle, and the Weymouth is carried lower in the mouth). Though the use of fixed cheek bridoons (Eggbutt, D-Ring) is legal, it does not make much sense if one is aware of the performance of these cheeks.

Recent results in of the experiments investigating the action of lever bits indicated the importance of something that obviously has not been taken into account before: At first, the

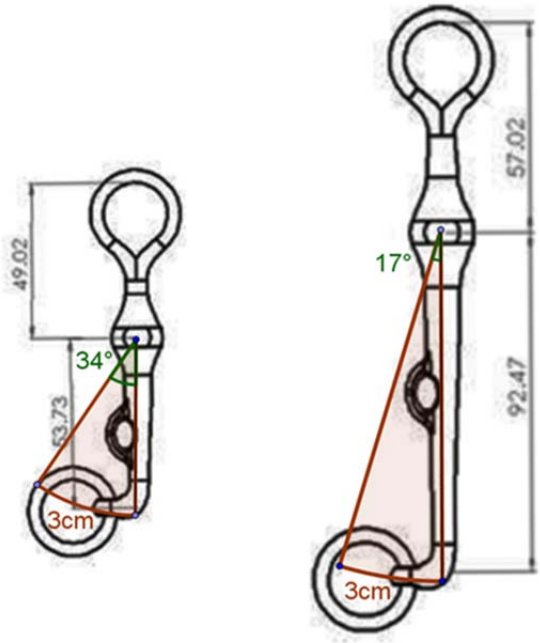
observed data seemed to be completely baffling (see Technical Information below). The explanation is an unsuspected interaction of the bridoon and the Weymouth bar, by which rein tension of the bridoon reins is transmitted to the Weymouth. To avoid this undesired effect, the mouthpiece of the bridoon should be shaped as flat and flexible as possible. Extreme curvature of the cannons or fixed cheeks are problematic, and the typical single jointed bridoon with straight cannons is definitely unsuitable, as it forms a forward tilted triangle over the tongue. The picture shows the daunting effect of an especially unsuitable combination.

## Technical Information:

**Would you have suspected this?**

This last Technical Information shall be used to draw attention on two facts, which are not difficult to understand, but generally obviously underestimated.

**Longer shanks allow subtle interaction!**

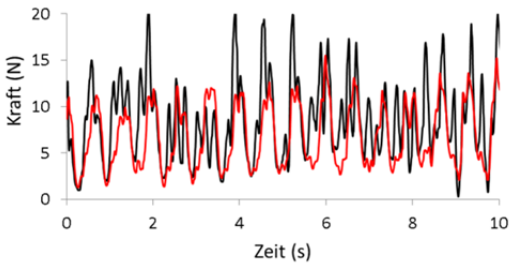



Imagine taking up the Weymouth reins and shorten them by 3cm. The rein is attached to the far end of the shank, which can move around the mouthpiece on a circle. The circumference of a circle is 2*π*r, with r being the shank length. In case this has a length of 10 cm, the shank will assume an angle of 17°, as can be seen in the picture. If you use a baby Weymouth with only 5 cm shank length, the resulting angle will be 34°. This means that a shorter shank generates a much more pronounced effect on curb chain and poll than a longer one!

You can also express it in the following way: Shortening the reins by 4 cm will be enough to achieve the maximum angle of 45° with a baby Weymouth, whereas you can shorten them by 8cm if you have 10cm shanks. Longer thanks actually facilitate a subtle use of the Weymouth!

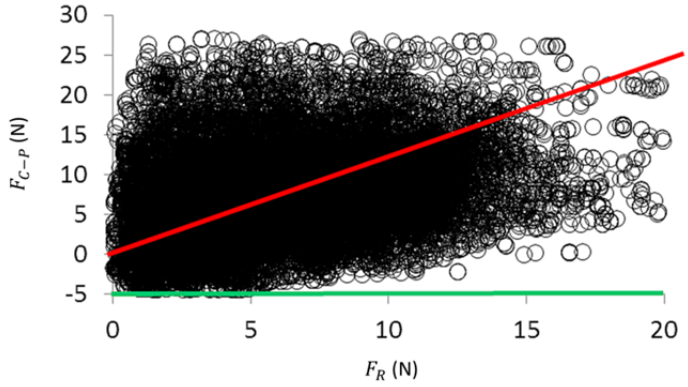
**Stunning interaction observed between Weymouth and bridoon!**

During the previously described experiments to determine the effect of lever bits, the Bluetooth equipment recorded both rein and cheek piece tension values simultaneously every 5ms over a time of 30s (diagram below)



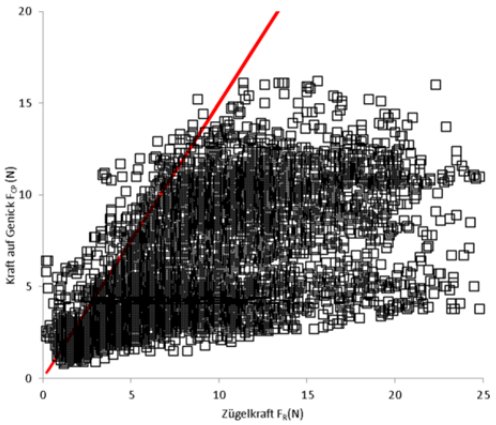

The recorded rein tension is depicted in black, the corresponding tension in the cheek piece in red. It can be observed that the signals from the rein show impulse character, the average force applied is 8N (corresponds to 80g). In this diagram type, it is not possible to find out which value of rein tension $F_R$ results in which poll pressure.

In the diagram below, the value of the Weymouth rein tension $F_R$ is noted on the x-axis, the y-axis is used for the corresponding tension observed in the Weymouth cheek piece $F_{CP.}$ Thus, every recorded data pair is depicted as one dot. According to the theoretical correlation determined by the mechanical advantage MA of the lever, all dots possible should be on the red line.
Of course, we do not expect real data to form a line, and thus we were not astonished to get a cloud, when all recorded data pairs are presented in one picture:

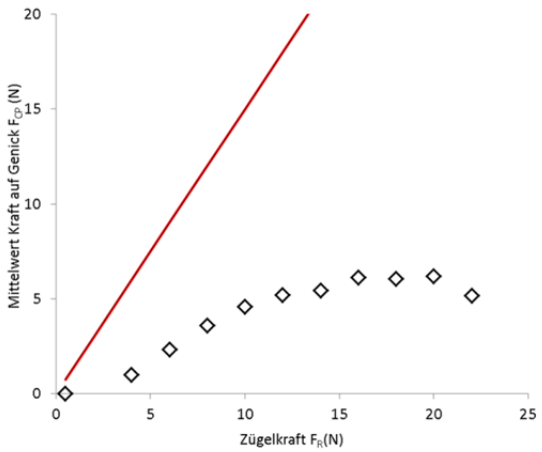



What we had not expected was to find the majority of the dots lying ABOVE the red line! That means a big magnitude of cheek piece tension resulting from little or no rein tension! This cannot be explained with any type of lever action – there had to be something else applying a force to the cheek piece.

We found the answer when the reins of the bridoon, which had been used as usual, but not recorded (the equipment can only record one pair of tensions at a time), had been removed.




A repeated recording provided the data depicted in the diagram on the left: The data points are still a cloud, but appear now only in the (physically possible) area below the red line. Obviously, in the first attempt, the bridoon mouthpiece got stuck over the Weymouth bar (in spite of having been fitted with the usual care) and pulled it away from the cheek piece.




For this diagram, the average value of the cheek tensions for each rein tension value has been calculated. It confirms the former observation, that the rein tension actually transmitted to the cheek piece is only a fraction of the theoretically expected value.