Dear Colleagues

**The origins of rifle shooting in physiology**

**The Problem:**a shooter who supports the rifle dead still (no visible signs of movement), right up to and including the moment of release, relies upon the principles of human physiology.

To the present day it appears that perhaps 90 percent of TR rifle shooters have not been taught how tosupport the rifle dead still, utilizing the physiology of the muscular and skeletal systems of the supporting arm linked by a sling. As well, the majority of shooters do not appear to understand how to ensure these systems are stable and in this way, avoidchange of the natural point of aim. Most shooters practise and attain a degree of success, without fully understanding the physiological factors in order to comply with them. Until shooters learn for example, that muscle tissue of the arm is unable to support a rifle dead still, then it will be impossible to release shots and produce groups as small as 1MOA (TR) or 0.5 (F Class).

This article illustrates the need to understand and comply with the physiological principles concerned with:

* positioning of the elbowof the forward arm, so that the linked muscular-skeletal system of this arm may alone enable the total weight of arm and rifle to be supported dead-still
* muscular systems interconnected through the bodyfrom head to toe
* the muscular and skeletal systems of the supporting armlinked together by a sling, so that support of the rifle is achieved by the skeletal system alone.

**Discussion:**in 1859 when rifle shooting was introduced by Queen Victoria, as a challenge to civilians who did not favour conscription, some of the most eminent scientists and physicians volunteered to solve the difficulties that confronted rifle shooters. Sir Arthur Conan Doyle (1859-1930), a writer and physician, and Rudyard Kipling (1865-1936), a writer, each founded rifle clubs in which civilians could be systematically taught the skills of rifle shooting. This was then and is now the foremost reason for rifle shooters to belong to rifle clubs. The Scottish physicist and mathematician, James Clerk Maxwell (1831-1879), calculated the distances apart of lines required on the vertical arm of the rear-sight, which enable shooters to allow for the trajectory of a projectile over a range of distances. Many volumes by learned rifle shooters, who were also engineers, scientists and physicians, were published prior to 1900 and are available today through library search programs.

Positioning of the elbow of the supporting arm directly underneaththe rifle, will enable it to be supported dead still, a result of no sideways tension required to balance the force exerted directly downward by gravity. If the tension from the supporting arm is at an angle, i.e. not directly upward but to one side, then further sideways tension must be provided by muscles of the supporting arm and shoulder. There is often also a need for further tension from muscles of the chest and other shoulder. Hence, for many shooters it is usual to balance the weight with both elbows used as balance points. When this occurs, the shooter’s total supporting force involves muscle systems of both the supporting arm and the shoulder that absorbs recoil.

It should be noted however, that some excellent shooters produce remarkable scores while balancing with a proportion of weight on both elbows. These shooters need to dismantle the position and reload with the butt on the ground. On the other hand, a shooter who balances the weight entirely on the one elbow as fulcrum, is able to reload at the shoulder by raising the loading arm and elbow, then replacing it, without risk of disturbing the rifle support position. As well while reloading, the rifle barrel does not wave around the sky above the targets, with a risk of shifting the position of the elbow by a few mm. This is a very common error factor and leads to a widening of the TR group from 1 to 2 or more MOA.

An important physiological aspect of muscular and skeletal mechanisms is theirinterconnection from head to toe. TR shooters have confirmed that aiming of the foresight depends as much on the positions of a foot and the elbow of the arm that supports the rifle. This has been found to be so sensitive, that sideways movement of a foot by as little as a cm or so, will move the foresight and hence the group, by as much as 2 to 3 MOA sideways. This accounts for many 9 to 3 o’clock shots out of a group. Most shooters are oblivious of this and move their feet and the pelvic girdle during a shoot

F Class shooting arose out of TR, through a desire of at least 50 percent of shooters, to avoid the known difficulties of holding the rifle dead still with a sling. TR shooters utilisea sling to link bones of the forearm and the upper arm, so that associated muscles have no part in supporting the rifle. This requires an understanding of the physiology of the interlinked bones and muscles, which need to be held with minimum tension afforded by the sling. If the tension is insufficient, then some arm muscles will also become involved in supporting the rifle. When a sling is used effectively, it can result in a 1 MOA wide group. If arm muscles are also involved, the group can extend 2 to 4 MOA vertically, i.e. a majority of shots are above and/or below the bullseye. This is due to fluctuations in the physiology of muscles, which cannot provide constant tension. The advantage of an inanimate sling is that the tension provided is unchanging. On the other hand, muscle tissue undergoes periodic breakdown and so cannot provide constant tension.

**Practical:**many successful shooters avert predictable physiological effects upon their groups by:

* placing the elbow (of the arm supporting the rifle) directly in front of the head on an imaginary line between the eye and target, then adjusting the positions of the left foot (RH shooter) and navel until the foresight is aimed directly at the target. This elbow is then kept perfectly still throughout the shoot, while consciously preventing any slippage of the elbow to the left (a RH shooter)
* ensuring the stock rests upon the web and the large muscle of the thumb, with the hand extended straight out from the arm. Any bend in the wrist will create pain
* taking action beforeevery shot(by adjusting a foot or the navel by a cm or so), to repair any change of the natural point of aim, which may arise from even the smallest movement of a muscular system anywhere in the body
* testing and adjusting the adequacy of sling tension beforeevery shoot. The test is to first come onto aim and suddenly allow arm muscles to become limp, so that upon the foresight dropping slightly, the sling is taken up a notch until this no longer occurs
* consciously relaxing automatically-tensed arm muscles while aiming every shot.

**Conclusion:**physiological systems of the shooter’s body need to be considered, so that all shooting techniques comply with the principles of each system. It would be beneficial for a shooter to find out about these principles, so that he/she does not widen a group from working against them.

Probably the most damaging effect upon a shooter’s performance arises from having not supported the rifle with the forward supporting hand directly under the stock, instead of at an angle to gravity. Balancing of the rifle with the forward elbow as fulcrum, is possibly the single most important technique for holding the foresight dead still. Sadly, the most common error of shooters is to support the stock with the elbow placed out to the side of the stock. This in turn leads to the stock being placed across the palm instead of the web of the thumb. Again, this leads to the hand being twisted sideways at the wrist, creating a distracting source of pain for the shooter.

The inter-connection of muscle systems throughout the body is also often ignored, simply because a shooter does not understand that this exists. A shooter may as a result, avoid losing unnecessary points by monitoring and correcting for change of the natural point of aim.

Best regards

Geoff