

WHO'S BUILT BEST TO RIDE?

Recognizing the Anatomical Differences Between Men and Women and Revising Traditional Teaching Techniques May Make Better Riders of Both Genders

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Preface: This article was originally published in the June, 1989 issue of *Equus Magazine* (no. 140). The subject it addresses – male vs. female bony anatomy with respect to riding – was a first. This is something that can only very rarely be said of any topic relating to horses or horsemanship. The response was tremendous. The article won a national magazine publishers' award, and fairly promptly after that there appeared a whole slew of seminars, books, videotapes, etc. (none of them written or promoted by me) about “women in the saddle”. Today, more than 15 years later, I still hear talk on the subject of male vs. female anatomy and function in riding — mostly by people who never mention my name because they do not realize that the information presented here represents original research.

I had strong impetus, both good and bad, to research and publish this information. On the bad side lay much of the instruction that I had been receiving at that period of my life from dressage practitioners, all of whom moronically out of doctrine – as they still do, and as your own instructor probably still does — insisted that I throw my belly forward and sit the trot with the the joints of my lower back hyperextended and “hollow”. This began by being painful and proceeded, within a couple of years, to being excruciating. Finally, with an “internal wisdom” that I bless my guardian angels for preserving in me, there came a day when I knew that if I got on the damned horse one more time I was going to rupture a disk. My doctor confirmed this intuition very shortly thereafter.

This sent me to the good side, which turned out to be Sally Swift. I attended two clinics led by her and was taught how to release the muscles of my lower back and allow it to flatten – as much as my bone structure allows. And, dear reader, you will shortly see *exactly* how much it allows, because not only are figs. 5, 11, and 14 photographs of me, but the female X-rays (figs. 3 and 8) are of my very own pelvis. Nor am I some kind of odd body type, but rather a very typical middle-aged woman of European extraction. I was 34 when the original black and white photos were taken; the color photos, supplied with this version of the article, show me in my late 40's. I tell you this so that you can compare your build and your experiences to mine.

Prior to getting help from Sally Swift, I had never been able to sit my mare's trot without bouncing. Afterward, I could sit both the trot and the canter with ease, and thereafter have much preferred to sit the trot than post to it. The key insight which she provided was that in order for the muscles of the belly (or in a horse, the underline) to be effective, the muscles of the back (or the topline in a horse) must first be in release. As those of you who have read Ms. Swift's books know, her method is largely based on the Alexander Technique, which is a motion of the head which induces the desired release. It is, in fact, the human version of “head twirling.”

I present many interesting facts throughout this article which you will benefit from considering – especially if you teach horseback riding. To further amplify and make clear, I have added photographs

and illustrations to this version of “Who’s Built Best to Ride” which did not appear in the original article.

This article was originally Part One of a series – the follow-up article gave techniques. However, since many of these techniques are better explained in other articles in this Website (particularly in our online Q/A Horsemanship Forum), it would probably be best to just take your time in digesting this information, since much of it is likely to be new to you. —Deb Bennett, Ph.D. – July, 2008



WHO’S BUILT BEST TO RIDE

Introduction

The history of riding is almost wholly a history of men on horseback. This is not the lament of an angry feminist, but a factual statement about war, conquest, the migration of peoples and the history of the art and science of horse training itself. The mounted warrior women of history, or even of mythology, are few: Joan of Arc, the Amazons and a few Valkyries come to mind. Yet since World War II, profound changes

Fig. 1. Both sitting well yet seated quite differently, dressage riders Robert Dover and Kay Meredith reveal typically male and typically female adaptations to the problem of sitting down to an athletic trot. While before World War II, the majority of the world’s riders were men, women today are the new majority. Because womens’ bony anatomy differs markedly from that of men, the technique which a woman uses for “following the movement” must be different from that used by a man. Instructors of both sexes would do well to take note of this fact and modify their instruction accordingly.

have overtaken horsemanship. Horses are no longer necessary instruments of war, agriculture or even of transportation in the developed countries. And women, not men, now form the vast majority of riders.

Women today regard with skepticism the patronizing and chauvinistic propaganda of Edwardian and Victorian doctors, who made decent women blush to ride astride. Now almost everyone, male and female alike, rides astride in the boots and britches of a nineteenth-century page boy, the tux and tails of the merry socialite of the 1920's, or in the jeans and fringed chaps of a cowboy. Except in the context of a pageant, gone are the days when a lady rode to hunt or hawking sitting sideways behind her man. Relatively rare, too, are sidesaddle classes at shows.

It will be our loss, however, if in a confusion of politics with biology we throw out the baby with the bathwater. Despite women's rejection of men's ideas of equestrian decorum, the ways in which a sidesaddle – or any other saddle – might be adapted for the female physique bear serious consideration. The greatest horse cultures that the world has ever known, including the Comanches, Sioux and Crow of the nineteenth-century Great Plains of North America, traditionally built different types of saddles for men and women. The different saddle designs reflected not only expected social roles and work duties, but also the consistent differences in bony anatomy which exist between men and women.

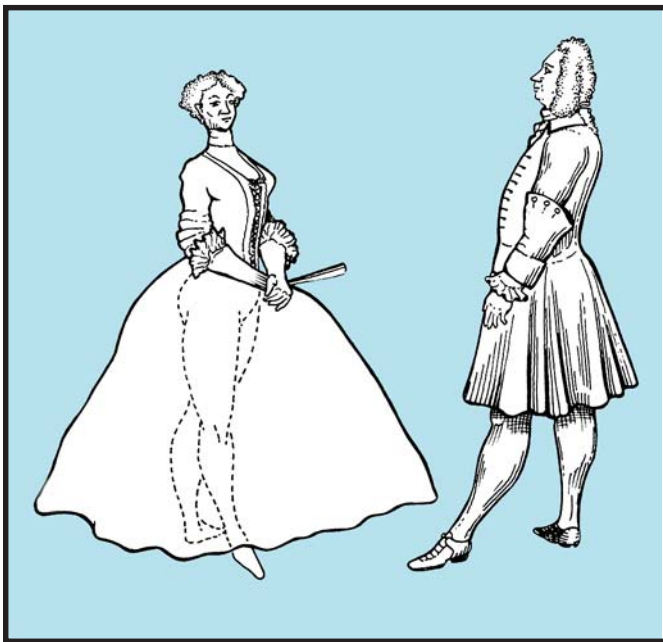


Fig. 2. The fashion for a posture founded on hyperextension (hollowing) of the lower back, throwing forward of the belly, and hyperextension at the knee joint, traces to Pierre Rameau's "The Dancing Master" of 1725. It pretended to teach wealthy people what was expected of them at court and in fine society. What it actually did, and still today continues to do, is damage the bodies not only of riders but ice-dancers, gymnasts, figure-skaters, and ballet dancers.

Structural Distinctions

In the musical "My Fair Lady," Professor Higgins asked the rhetorical question, "Why can't a woman be more like a man?" The answer in equitation isn't rhetorical, but practical: a woman can't ride like a man because her lower back, pelvis and thighs – parts whose correct functioning is most critical to successful riding – aren't constructed like those of a man. This is not to say that women can't ride astride; only that these anatomical differences dictate a different approach to tasks like half halts and the sitting trot for women and men. They also mean that women will tend to have different physical difficulties in learning to ride, and different strengths and advantages once they do learn, than men.

Because historically men have worn the britches in the family, riding instruction – especially systems such as those for dressage and three-day eventing, which were the former purview of the military – have been designed for and tested extensively upon men. Riding techniques which work for men don't work as well for women, and some can even be physically harmful to them. The first step in devising efficient and effective

methods for teaching women equitation, is to make certain that both riders and their instructors know the differences between male and female anatomy, and understand how such important parts as the hip sockets, lower back and seat bones of each sex function in the saddle.

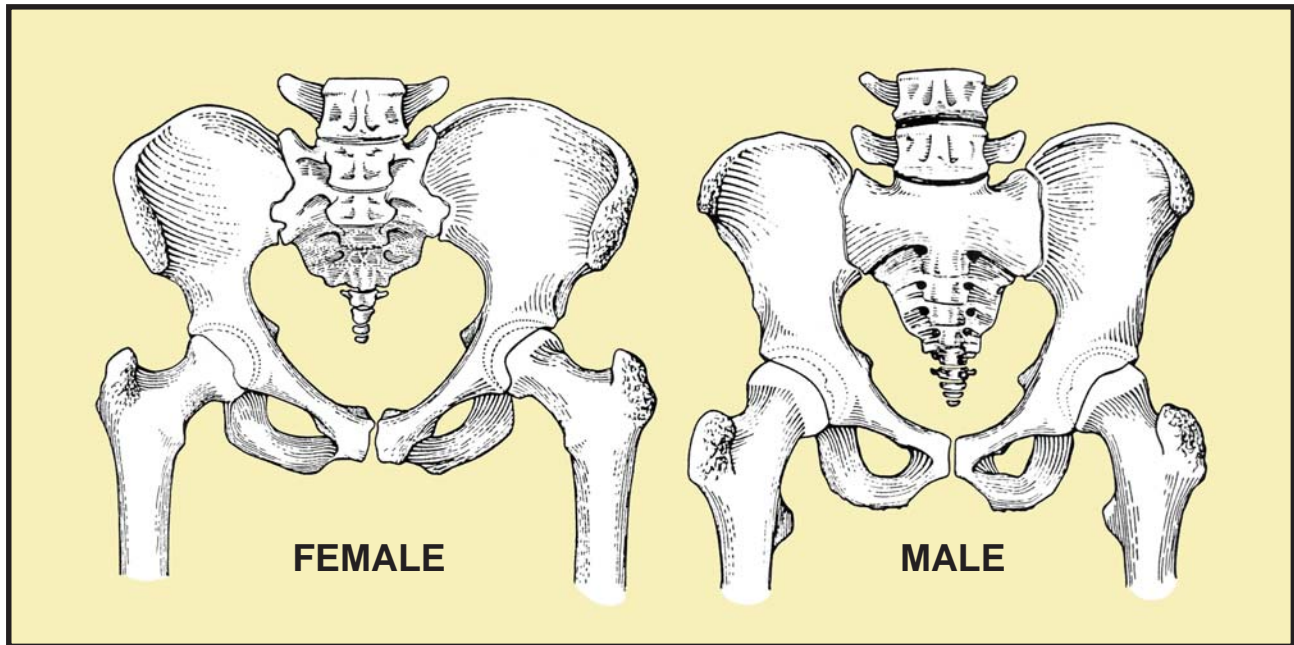


Fig. 3. Female and male pelvises in front view. The female sacrum (tailbone) tips strongly toward the back and tapers more strongly toward its lower end than does the male's. Because of this, the male sacrum blocks the birth canal (the central empty area) much more than does that of the female. Note also how close together the hip sockets are in a man vs. a woman.

The Pelvis

Almost unique in the history of life is the erect, bipedal walking posture of our species. Through time, the human pelvis has changed from the long, narrow form seen in dogs, horses, and gorillas to a wide, squat, bowl-like form suited for anchoring our legs and providing a solid floor to support our viscera. While a cresty neck and large canines differentiate stallion from mare, our species shows much greater physical differences between males and females, and the most marked are found in the pelvis.

The pelvic construction of men and women is different because women bear children with heads that are enormous by other species' standards. A woman's birth canal is wholly enclosed and limited in size by the ring of bone formed by her pelvis. As a result of the biological imperative of successful childbirth, women's pelvises are almost universally wider and deeper, with a more circular pelvic outlet than men's. A woman's pelvis is usually also much larger relative to her other body parts than is a man's.

In terms of riding, at first glance it would seem that women might have the advantage: the greater width of the female pelvis ought to make the task of sitting over a big, wide horse less taxing. Moreover, the proportionally large size of a woman's pelvis has the effect of lowering her center of gravity when seated on horseback and thus of making an equestrienne more stable and harder to dislodge than a man. Unfortunately, however, in the military systems of riding instruction, especially those that demand that the rider "follow the horse's movement" in sitting trot and canter, these advantages are nullified. A rider doesn't really function like a mounted bowling pin; besides a bottom, she also has a torso above and

legs hinged on below, and neither a woman's lower back nor her legs articulate with her pelvis like those of a man. Part of the pelvic structure itself, a woman's seat bones are also shaped in a characteristically feminine way.

The Seat Bones

The rocker-shaped seat bones or ischia form the lowermost part of the human pelvis, and no matter whether you sit down to a trot after the manner of a gaucho or of a dresseur, you must sit upon your ischia. What anatomical parts, if any, you sit on in addition to these has been for three centuries a matter for debate in every school of equitation. What is certain is that the ischia are shaped very differently in women and men, and this shape difference leads directly to different riding habits in the two sexes.

One such habit is "slouching". Everyone agrees that slouching – on or off horseback – constitutes bad posture. Because of the shape of his seat bones, when a man slouches, he rounds his lower back and sits on his tailbone, the classic "cavalry crouch." Men competing in amateur Western pleasure, polo, and reining often "sit on their pockets," too. This posture is rarely seen in women, because a rounded lower back is anatomically quite difficult for most women to achieve.

One of the obsessions of dressage instructors over the last 300 years has been to eliminate slouching by teaching young men to hollow or "hyperextend" their lower backs. This posture derives, in part, from a series of instructional books called "The Dancing Master." Widely influential in eighteenth-century Europe, "The Dancing Master" taught that men and women of culture should carry themselves in a posture founded on hyperextension of the lower back, which prevents slouching by inducing lifelong habitual contraction of the back muscles.

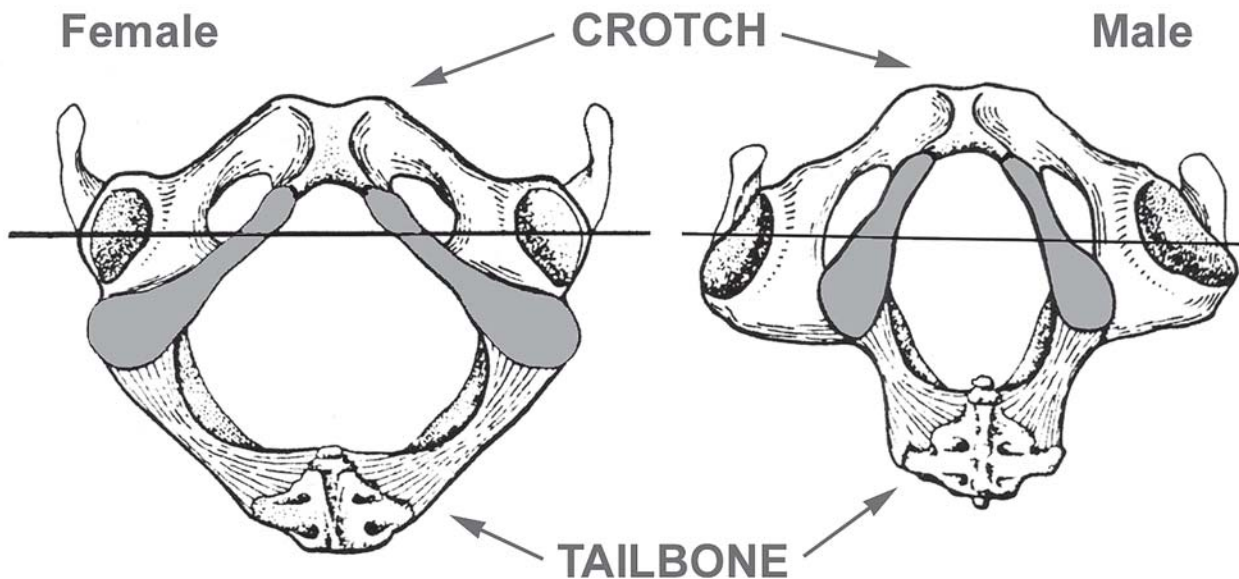


Fig. 4. The pelvis as the saddle "sees" it. Note how widely the female ischia (the "seat bones", dark gray) diverge, while those of the male are nearly parallel. While a man's hip sockets face forward, a woman's face more out to the sides. The axis of a woman's pelvis falls farther toward the front of the ischia, while a man's divides them into balanced halves. For these reasons, a woman's pelvis "wants" to balance toward the front, and it costs a woman effort to lower her tailbone. A man, by contrast, can easily sit "on his pockets".

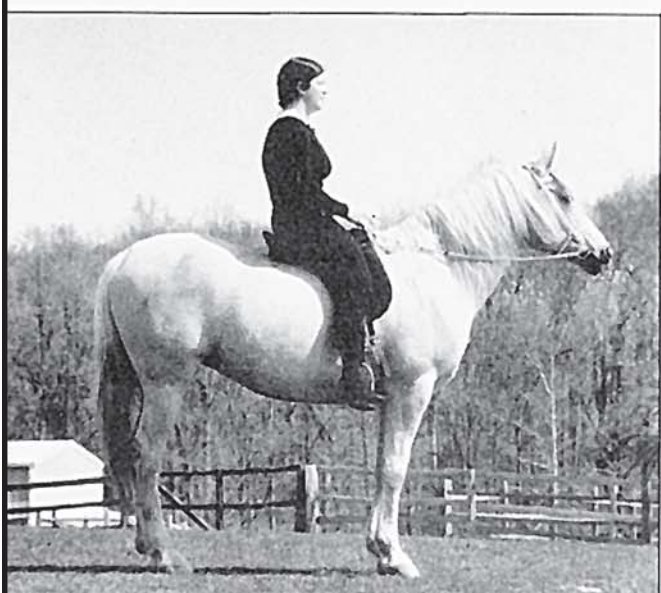
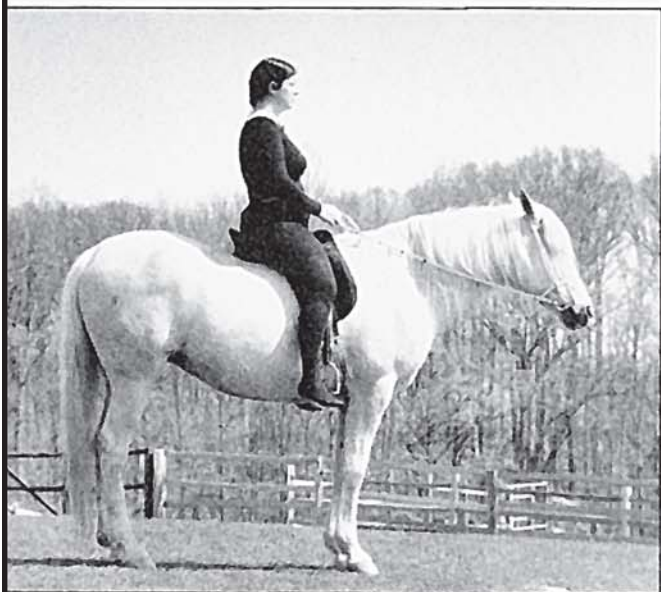
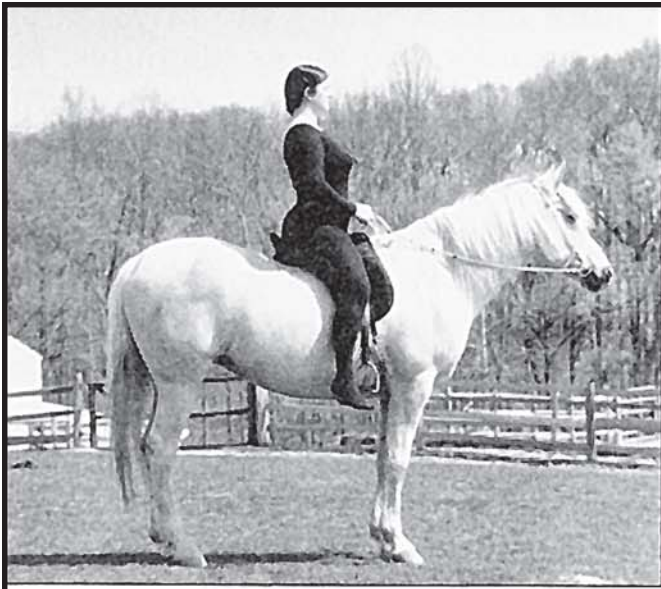


Fig. 5. This and the following two photo strips compare three different riders each taking three different positions on a single horse (the horse is my faithful helper, Sadie, at the young age of 22).

The three different riders are: myself -- blocky, muscular "mesomorph" build, age 34; Jennifer, lissome and beautiful, one of our editorial apprentices at Equus Magazine, who was kind enough to volunteer as one of our models, age 22; and Jim, age 24, a handsome and fit mesomorph, one of our sales reps and the magazine, who also volunteered.

The three different postures that each of us demonstrates are:

Upper photo -- hyperextension (hollowing) of the lower back, and concomitant downward drop of the crotch.

Middle photo -- "normal" posture, neither hyperextended nor slack. Rider sits "square" on the seatbones.

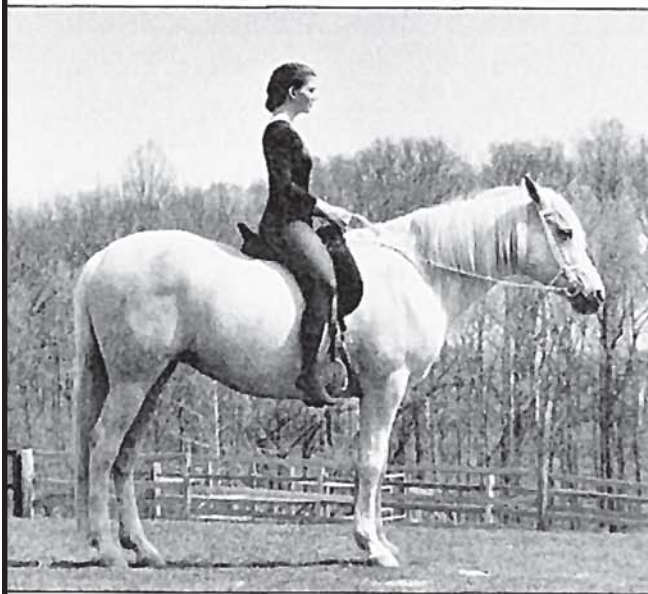
Lower photo -- "Slack" posture with rounded lower back; rider attempts as far as possible to sit "on the hip pockets."

Please take the time to compare this series of photos with the X-ray tracings of male vs. female pelvis and lower back shown in Figs. 8 and 9. It is simply not anatomically possible for me -- or most other women -- to get the lower back as flat as the average man.



Fig. 6. Jennifer on Sadie.

Hyperextension (hollowing) of the back. Note how this pushes the crotch down, causes the rider to round her upper thoracic curve, and project her neck forward, sticking her chin out. The downward rotation of the crotch closes the angle between the pelvis and the thigh.



“Normal” sitting posture; sitting “square” on the seatbones. The spinal curves are all less extreme; the angle between the pelvis and thigh is wider open.



Rounding the lower back, sitting “on the hip pockets” as much as possible. Generally in woman, this effort produces more rounding of the upper back and shoulders than of the small of the back. Some individuals will also want to carry their elbows wider out to the sides, and many will also raise their knees -- this is called a “chair seat”. Having the knees somewhat high is a necessary trade-off for many women riding astride; unless they raise their knees, they cannot really soften and flatten their lower back.

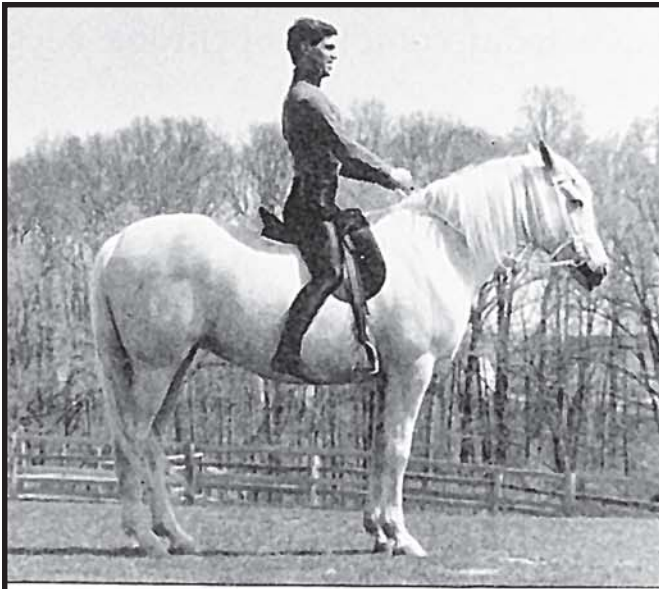
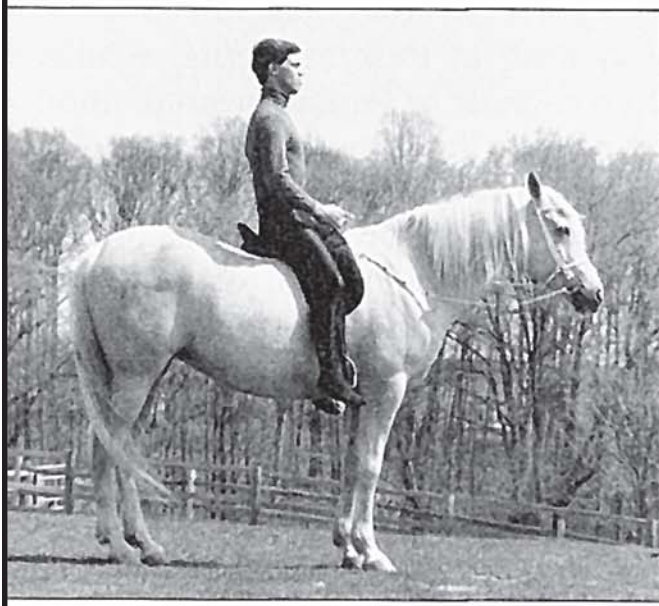
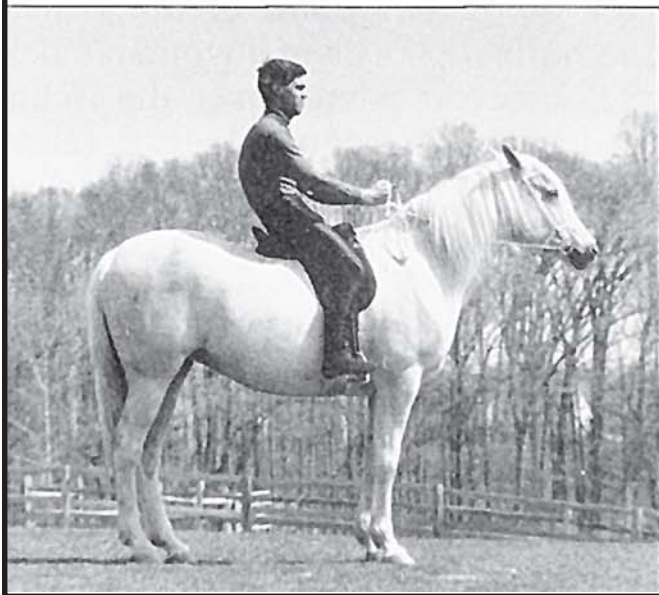


Fig. 7. Jim on Sadie.

Hyperextension. Compare the degree of hollowing that Jim is able to produce with Deb's and Jennifer's; it is much more difficult for Jim to hollow his back, although with effort he can do it. Hyperextension of the lower back is the foundation of the "military" posture, for it forces the man's chest and shoulders to rise, making them look bigger and more impressive. Note how the down-dropping of Jim's crotch forces his thighs backward, to a greater extent than in either of the women.



"Normal" posture; sitting "square" on the seatbones. Note the totally flat lower back and the slight rearward tilt to Jim's body. There is a hint of stiffness here, the usual downside of muscular strength. When the lower back flexes, both in a man and in a woman, the "give" should be toward the *back* rather than toward the front.



As much "rounding of the back" as Jim could produce. It is remarkably greater than that which the women could produce. Note that the point of greatest spinal curvature is below Jim's "bra line". The lower back remains totally flat, but the pelvis as a whole has rotated thirty degrees to put all of Jim's weight on his "hip pockets" and raise the crotch a considerable amount. There is a tendency here for the knees to rise also.

Fashion forced extremes in this posture during the eighteenth and nineteenth centuries with the adoption of corsets and bustles, which served to accentuate the hollow lower back and prominent buttocks that result when either sex adopts this carriage. Though today we may be tempted to laugh at what looks like a silly foible of our ancestors, the lessons of “The Dancing Master” still influence the standards of academic equitation.

The shape which the ischia present to the saddle dictates their functional properties. A man’s near-parallel ischia function like the parallel wheels on a toy wagon: they permit the pelvis to roll freely forward and back. A woman’s ischia, by contrast, diverge strongly to the rear. Like bent wheels on a toy wagon, they resist rolling freely especially to the back.

The horizontal axis of a man’s pelvis, from hip socket to hip socket, also helps him to rock backwards onto his tailbone, because the axis passes over the center point of the ischia. The horizontal axis of a woman’s pelvis, however, passes over the ischia close to their forward edges. Because of this fact also, a woman’s pelvis “wants” to balance itself toward the front, pubis downward and tailbone up, just the opposite of a man’s. It costs a woman physical effort to lower her tailbone, whereas a man must make an effort to lower his pubis.

This anatomical fact makes it clear why men and women do not typically “slouch” in the same way. If a woman slouches, typically the slouch does not originate low down, but high up in the region of the shoulder blades. It is of prime importance that instructors correctly diagnose the origin of slouching in their students, whether they be male or female (there is some overlap: a small minority of men have wide, divergent seat bones; an even smaller minority of women have narrow, parallel ones).

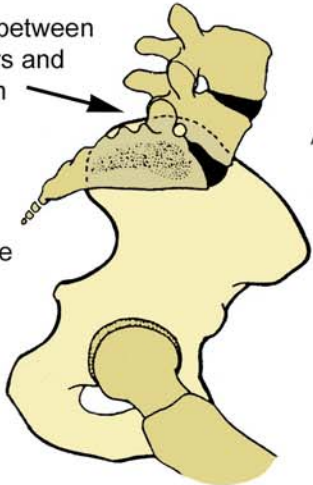
The traditional correction for the slouching cavalry recruit is to instruct him to “push” or “throw” his belly forward. This command asks the young man to make the physical effort necessary to lower his pubis. He will then sit farther forward on his seat bones, pressing his pubis closer to or even down upon the pommel. This is called the “seat on three points.” This seat has been shown to be comfortable and useful for many men, and it is not painful for most men to practice it.

An instructor, however, who fails to diagnose the anatomical origin of bad posture in his female students, and demands that they, too, lower their pubes, places them in physical danger. As an X-ray tracing of one woman shows, slouching by rounding her lower back isn’t even possible for her. If she slouches, her shoulders become round, but her lower back is always hollow. Asking this woman to touch her pubis to the saddle or to throw an already hollow lower back farther forward, causes extreme hyperextension of the joints which form the lower back and its junction with the sacrum. This, in turn, pinches the intervertebral disks and causes the articular surfaces between the lumbar vertebrae to override one another. Should her horse take a single jarring step while her back is in this position, a woman built like this is in danger of partial vertebral dislocation, disk rupture or even broken bones. Between misdiagnosis and anatomically inappropriate instruction, it isn’t surprising that many women riders today complain of chronic back pain.

FEMALE

Angle between
lumbar and
sacrum

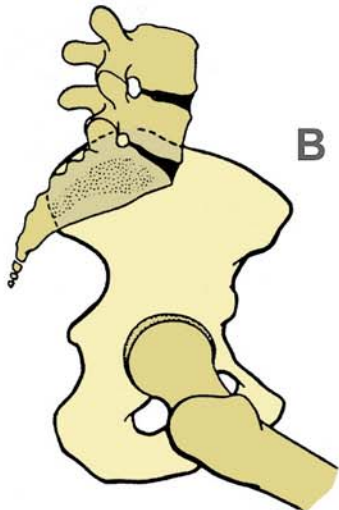
Length
of
tailbone



A

AS "HOLLOW" AS THE PERSON COULD MAKE HIS/HER BACK

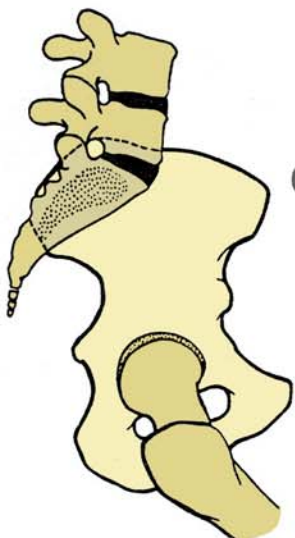
*This posture is caused by
tightening the muscles of
the back.*



B

"NORMAL" OR RESTING POSTURE

*Ideally this will
be how you sit,
whether male or
female. Your overall
balance on horseback
depends on the balance
of your pelvis. When in
balance, little muscular
effort is required to ride.
You aim for release of the
muscles of the lower back.*



C

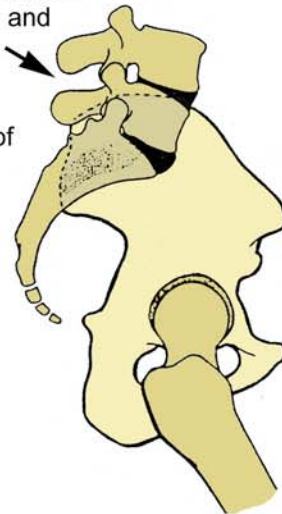
AS "ROUND" AS THE PERSON COULD MAKE HIS/HER BACK

*This posture is caused
by first releasing the
muscles of the back,
and then tightening the
muscles of the belly.*

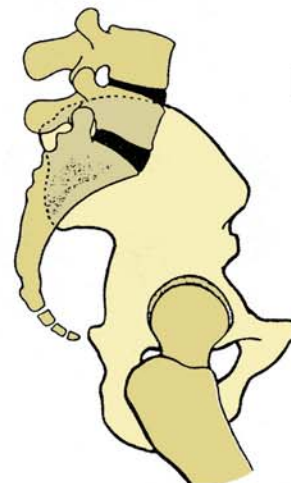
MALE

Angle between
lumbar and
sacrum

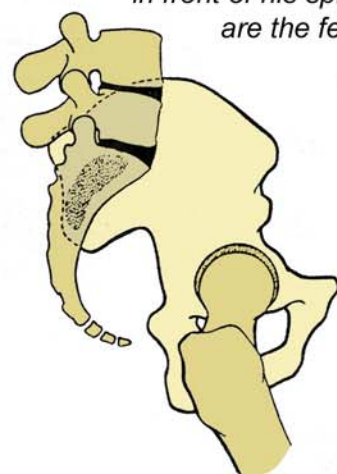
Length of
tailbone



A



B



C

*Note that the male's hip
sockets are always farther
in front of his spine than
are the female's*

The Lower Back

Though your mother may have tried to improve your slouching teenaged posture with a slap between the shoulder blades, this, like the myth of the Spanish Riding School *bereiter* trained with a board sewn into his jacket, presents a naïve idea of how to improve posture. In both men and women, good posture is built by stacking comfortably aligned vertebrae upward from the pelvis and sacrum. Good riding is impossible without good posture; in order to “follow the horse’s movement,” the rider’s lower back must be able to elastically traverse a full range of movement from extended (hollow) through flat to slightly flexed (rounded).

As in the case of the pelvis, low back conformation in men and women differs markedly. The differences in this body zone begin with the peculiar, triangular bone called the sacrum. Anatomically, the sacrum acts as a bridge – it is the keystone which connects the lumbar vertebrae to the pelvis and legs. The sacrum is shaped and articulated with the pelvis quite differently in the two sexes. Because the lumbar vertebrae are stacked atop the sacrum, differences in sacral shape and orientation dictate differences in construction of the whole lower back.

In most men, the sacrum is long and curving. The bone, therefore, impinges upon the birth canal space, but in a man this is of no concern. Because of his sacral shape, however, it is possible for the average man to sit upon his tailbone, something that will

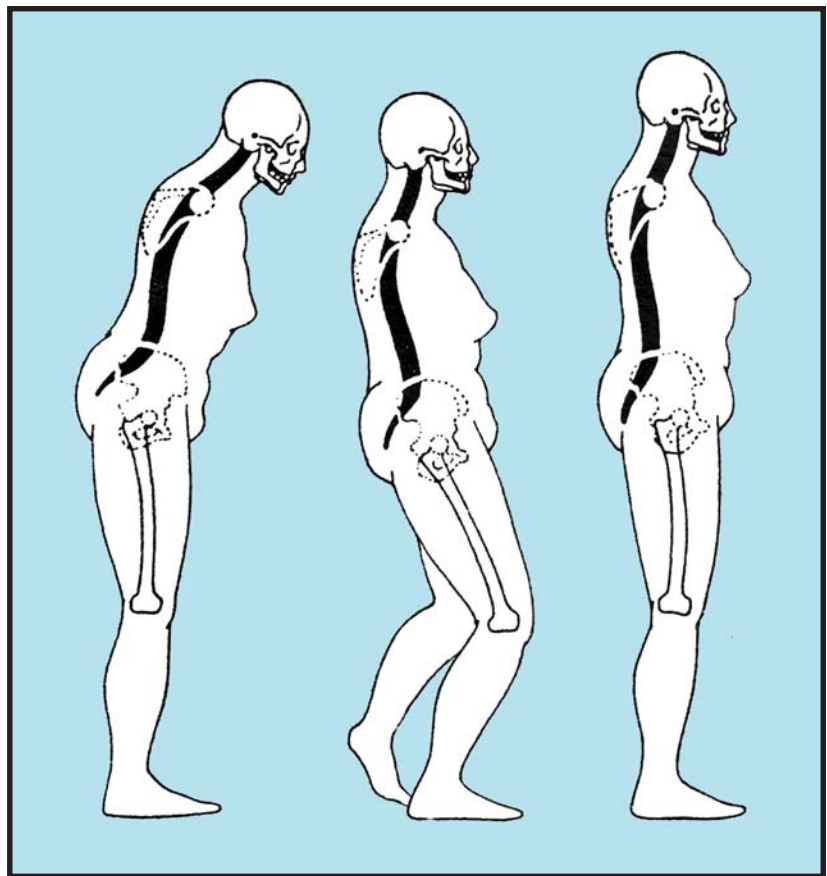


Fig. 9. Options that the female has for solving the problem of how to raise the crotch and flatten and ease the lower back:

Left: *bend forward at the waist*. This flattens the lower spinal curve, but after a few minutes the muscles of the lower back will feel a strain, as when the body is in this unbalanced position they must continuously support the weight of the upper torso and head.

Middle: *bend the knees and raise them*. This is the solution that promotes the most long-term comfort and ease. In the saddle, the rider achieves it by simply not attempting to stretch the legs downward or backward past the point where the thigh begins to “drag” the crotch downward.

Right: *make an effort to straighten out the spinal curves* with the deep muscles of the “core” (primarily the ilio-psoas complex which lies against the anterior aspect of the lumbar curve). Exercise systems such as Pilates and Yoga safely strengthen postural muscles and are good as off-the-horse developers. When in the saddle, you should not be exercising. Ride by feel and balance; whatever postural strengths you already possess will support you while you ride.

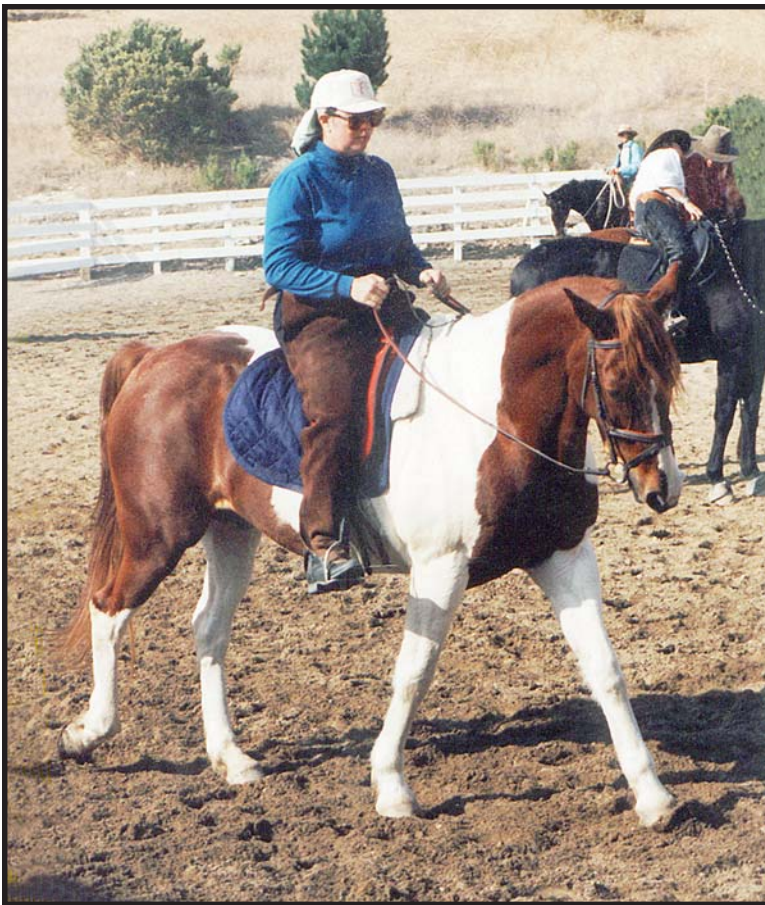
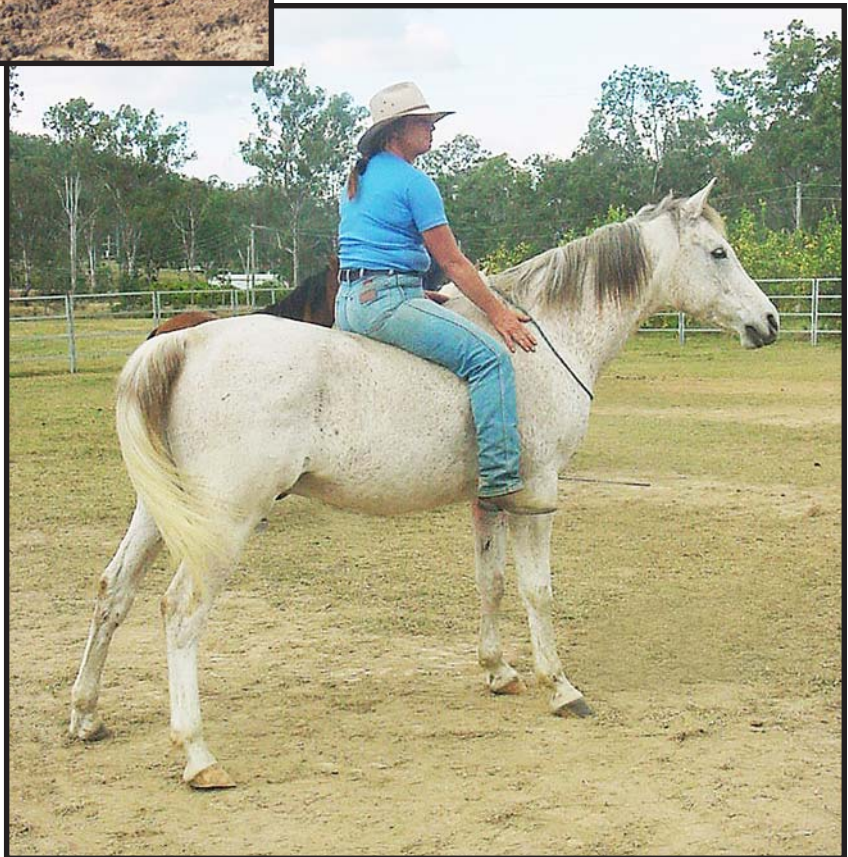


Fig. 10. Here I am on Painty Horse having a wonderful, relaxed ride. We're performing lateral work at a slow, relaxed, collected canter. Painty is totally OK about it, as you see from the wide "V" in his ears. He's making a maximum effort, too, as evidenced by the look of concentration in his eyes and the long, "pointy" lip that is a horse's way of saying, "I'm trying my very best." I'm just as relaxed as Painty. This photo was taken when I was 46 and Painty was 22. Believe it or not, I was not "trying" to get my heels down; they've sunk because my whole lower body, from my lower back downwards, is relaxed. This photo well shows how much Sally Swift's instruction helped me; I no longer have any difficulty releasing and easing my lower back, or "following the horse's movement."

Fig. 11. Why women so often tell me that they love to ride bareback. Very few saddles on the market today are actually designed to accommodate a woman's anatomy or to help her overcome the problem of dropping the front of the crotch. But horses without saddles have an entirely different shape -- most of them have the center of their back lower than the withers. They have a sort of "notch" or groove where the rider's leg naturally wants to go, and this groove is ahead of, rather than behind or below, the woman's hip sockets. Both of these factors help to tilt her pelvis up in front, ease hyperextension of the hip sockets and lower back, and help the woman to relax and flatten her lower back.





never be possible for the woman whose X-ray tracings accompany this article.

The male sacrum is also attached much more vertically to the pelvis than is a woman's. As a result, the lumbar region of a man's back is characteristically far less curving at rest than is a woman's. For both these reasons, even a thin woman's profile shows rounded buttocks, while men's derrieres appear flatter since anatomically the pelvis – and thus the buttocks which rest upon it – is tucked farther under.

For riders and riding instructors, the anatomical differences in low-back and sacral construction are even more important to understand than those of the pelvis and thigh. It is because a woman's sacrum is tipped that her lumbar vertebrae curve more than a man's. In addition, in a woman sitting "at ease" in the saddle, the hip socket lies under or even behind the column of lumbar vertebrae. If gravity is allowed to act on a woman's pelvis, it will rock forward and her lower back will hollow still more. By contrast, because his hip socket is located in front of his lumbar column, if a seated man relaxes his back muscles, his pelvis will rock backward; gravity will pull his tailbone down and, as his tailbone sinks, his pubis will rise.

Fig. 12. The young woman of lithe and long-waisted build (below) will be, of all females, the one most likely and most capable of sitting "on her hip pockets". However, a "slack seat" in a woman or girl still looks quite different from that in a male (above), because of the internal differences in bony anatomy.

Hip Sockets and Thighbones

A rider's "seat" is formed not only by the contact of the ischia and surrounding flesh with the saddle, but also by the upper part of the thigh. The ball-shaped head of the thighbone fits into the hip socket of the pelvis, but the orientation of the hip socket, the angle of the femoral neck and the angle of the femoral shaft are characteristically different in men and women.

In most men, the hip sockets face more toward the front than in women. This makes it easier for a man – even an obese man with thick upper thighs – to rest the inner surface of his thigh flat against the saddle, to keep his knee close to the saddle without pinching and to effortlessly point his toes forward. Fit women at their correct body weight need to stretch the muscles on the front of the thigh and the iliofemoral ligament, which when tight, limits the mobility of the femoral head.

The other outstanding characteristic of the female thighbone is the angle at which it descends from the pelvis. This, called the "carrying angle", is dictated by the angle which the neck of the femur makes with its shaft. Women tend to have hourglass-shaped thighs and calves, because their thighbones slant inward from the hips to the knees. In marching, the higher a drum majorette lifts her knee, the closer to the midline it tends to come, while the drum major's knee tends to stay farther out. The more a woman can open her hip joints, stretching her thighs farther back, the easier it will be for her to keep her knees wide apart and her toes pointed forward instead of out when in the saddle. Thus, the farther back a woman can learn to carry her knees under her when riding *without hollowing her lower back*, the better she will ride.

The lower end of the thighbone also reflects the carrying angle. Typically in men, the femoral condyles form an articulating surface which is nearly at a right

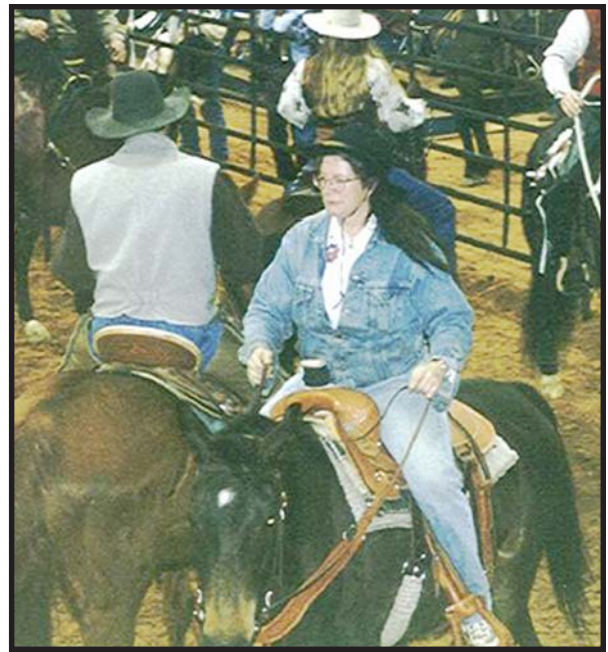


Fig. 13. Here I am at age 49 in 2001 participating as an invited rider at the Tom Dorrance Benefit Ride in Ft. Worth, Texas. The photo, taken from above in the stands, shows the truth about a woman's thighs: they're cone-shaped. And they're cone-shaped whether the woman is overweight, normal weight, or thin. This means that, when the woman is seated upon her seatbones, to ask her to turn her toes in, whether from the ankle or by rolling the thigh inward, is to needlessly strain her hip, knee, and ankle joints. Such efforts confer no functional advantage, no safety advantage, and are just posturing and posing. Instead, the rider, whether man or woman, should seek to bring the inner aspect of the calf into contact with the horse's barrel. When this contact is achieved, it doesn't make any difference where the rider's toes point. The rider should be taught to use the sartorius muscle to bring the leg closer to the horse or to bump, kick, or spur him when necessary -- never the hamstring muscles on the back of the thighs, or the large adductors which lie on the inner aspect of the upper thigh. The



angle to the shaft, while in women, the condyles are tipped. Because her condyles tip, a woman's calf bones do not hinge "square" under the knees, but angle outward toward the ankles. This, in turn, affects the orientation of the ankle and foot. For many women who have achieved a proper seat, and who wish their riding to be as effortless and uncramped as possible, with the leg simply being allowed to hang down naturally, offset or double-offset stirrups, accommodate the twists built into the female leg and are the design of choice.

If you've been struggling to sit better, just knowing the anatomical differences that characterize men and women will make a significant difference in your riding. If you are a riding instructor, these facts may cause you to rethink your approach to different students. The overall objective is, of course, to enable every person, man or woman, to be able to "follow the motion" and influence the horse with effortless ease.

Fig. 14. A couple of really great images showing how differently men's and women's anatomy functions. A male riding instructor can give a mounting demonstration in which he saddles a horse but does not girth it, then steps into the stirrup -- yet the saddle does not turn. This is possible because the male pelvis is so narrow that the man can get his body center much closer to the center of the horse's body than can almost any woman. These photos show exactly the same thing. Notice how much wider the woman's pelvis is than the man's. Note also the female "carrying angle" -- the woman's thighs converge from the pelvis downward to the knees, while the man's legs are parallel. Note also how different is the placement and weighting of the woman's feet. The whole anatomical setup makes the woman vaulter far more dependent upon upper body strength, timing, and her ability to spring upward than the man, who can make more use of balance.