Nautilus
&
Athletic Journal
Articles

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Avoding and Preventing Injuries

Exercise should help to avoid injury… not cause injury. But, it can do either. It can strengthen the muscles and joints of an athlete to such an extent that the possibility of a directly sports-connected injury is greatly reduced. Or… if improperly performed, it can cause injury that might never have occurred on the playing field.

Exercise can cause injury in at least two different ways… 1) an athlete may injure himself while performing an exercise, an injury that is a direct result of exercise… or 2) an athlete may hurt himself on the field as an indirect result of exercise.

Strength increases are stimulated by high intensity of work, and only by high intensity of work… a muscle must be worked to, or very near, a point of momentary failure. In practice it appears that approximately eight to twelve repetitions should be used for upper body exercises and about twenty repetitions for lower body exercises… but regardless of the actual number of repetitions performed, the exercises must be continued to a point where it is momentarily impossible to perform another repetition in good form.

In effect, if you could have done twelve repetitions but stopped after only ten, that exercise was probably wasted… little or no growth stimulation will be produced.

Do not continue an exercise to the point where it becomes necessary to change the style of performance in order to continue… doing so will result in throwing the weight instead of lifting it. This is neither necessary nor desirable, but dangerous.

Do continue for as many repetitions as you can possibly manage in good form… do not terminate the exercise simply because the movement become very hard, or because the muscles start to ache; strength building exercise literally must be hard, and if it is properly performed it will make the muscles ache.

In a set of twelve repetitions leading to a point of failure after the twelfth repetition, the first ten repetitions are largely preparation… most, perhaps all, of the actual growth stimulation produced by the final two very hard repetitions. So, if you stop one or two repetitions short of a point of actual momentary muscular failure, then a very large part, perhaps all, of the benefit will be missed.

Every single exercise in the entire workout must be performed in this same manner… each exercise must be carried as far as possible in good form. Do not terminate any exercise if it is possible to squeeze out one more repetition in good form.

Then… when one exercise is properly completed, move on to the next exercise as soon as possible; but not too quickly… not so quickly that your breathing or pulse rate acts as a limiting factor.

If you move on to your next exercise too quickly, then you may become lightheaded… or you may even become nauseated. So, you must permit a short breathing space between exercises… at least at the start of the actual heavy training.

At first, you may require about two minutes of rest between exercises; but, as time passes, you should gradually reduce the rest period between exercises… and, eventually, you should be able to go through a full workout with little or no rest between exercises. It may require two months of really hard training before you reach a condition where you can go through a full workout almost nonstop, moving immediately from one exercise to the next.

But do not rush it too much… if you do, then you will be unable to work the muscles as hard as they really require for best results. And do not permit the workouts to degenerate into a race against the clock; your total time for a workout should gradually decrease, and it will… but the important thing is to be very sure that the muscles are worked properly, but they will not be if you rush through the workout too fast.

Try to reach each exercise as a thing unto itself, as if each exercise were the complete workout; try not to think about what has happened before or what is to follow… if you hold back in anticipation of the next exercise, then you are defeating the purpose.

This brings us to the next time-related factor, the speed of movement during the exercise. This point, at the moment, is a point of enormous controversy… with some people saying train as fast as possible, and others saying almost the opposite. So just what is the best speed of movement? Well, quite frankly, nobody knows… although some people would have you believe that they do know.

But I can tell you what we have learned from our own experience; we have found that a fairly slow speed of movement produces far better results than a fast speed of movement… much, much better results.

I can also tell you what we have learned from our own experience; we have found that a fairly slow speed of movement during exercise does the following: it jerks the muscles violently during the first few degrees of movement… after which point the weight is moving so fast that the muscles literally are not involved in the rest of the movement. The result being that a dangerous yank is imposed on the muscles at the start of the movement and then absolutely nothing is accomplished during most of the movement. In such cases you are throwing the weight, not lifting it… and such a style of training will produce nothing but injuries.

Yet, in practice, that is exactly how many people train… which probably explains why it takes them years to produce a degree of results that could have been produced in an equal number of weeks; and it certainly explains why people who practice such a style of training eventually injure themselves seriously.

And… do not be confused by the current crop of double-talk about fast-twitch and slow-twitch muscle fibers; which is another subject that absolutely nothing is known about at this point in time… although, again, this is a subject where some people would like to mislead you into believing that they do know quite a lot about the subject. We have conducted at least ten times as much research in the field of strength training as everybody else in the exercise business combined… and this is a very conservative statement. At the moment we are building the largest and best equipped human performance center in the world, and this is in preparation for extremely large-scale research projects involving literally thousands of subjects… and we are in close, direct communications with the leading research scientists now involved in a study of different muscle-fiber types.

If and when we do learn something of value regarding different muscle types, then we will publish the information… and in the meantime, every single one of the articles on this subject that has come to my attention in popular journals consisted of pure hogwash and gross misquotes taken entirely out of context.

In closing this point, let me repeat that I do not personally know anything on this subject that has the slightest relationship to a practical application in exercise… and neither does anybody else.

As recently as four years ago, we used very fast speed of movement in exercise… but since then we have learned better, and I am certainly no ashamed to admit my past mistakes… and now we produce better results in six weeks than we used to produce in six months.

Injury that is directly caused by exercise will usually be obvious, and the coach will normally be aware of such an accident when it happens and will thus know where to place the blame. But *indirect* injury may not be so easy to recognize, since it will not result from a simple cause and effect type of situation that makes itself known immediately.

For example, if an athlete pulls a thigh muscle while performing squats in the gymnasium, the coach will know exactly where to place the blame. But if, instead, he pulls a hamstring on the field… the coach might not realize that the injury was an indirect result of exercise. And it might not be… but it could be.

If an exercise program results in a disproportionate muscular development in antagonistic muscles, then it is almost asking for trouble. For example, if an athlete develops great strength in the muscles of the frontal thigh while doing little or nothing to increase the strength of the rear of the thigh, then he may actually cause an injury. This injury would probably occur on the field, and probably would not be blamed on exercise.

Unfortunately, since the blame for such indirectly caused injury is seldom placed where it belongs, it is utterly impossible to estimate the number of such injuries with any reasonable degree of accuracy… but, I am personally convinced that the number would be quite high.

Thus, the known injuries from exercise, when added to the unknown, equal a high but unsuspected total.

Balanced against the unknown total, we have only another unknown factor in the way of compensation; since, obviously, it is also impossible to estimate the number of injuries that were prevented by exercise. After all, who can even guess just how many injuries might have happened?

Therefore, on the surface it may well appear that exercise merely causes injuries… while offering nothing in the way of value in return.

In fact, simple common sense also makes it obvious that a stronger man is less likely to be injured in any given situation… and that a more flexible man is also less prone to injury.

Many years ago, when I first started flying, a student pilot was required to practice spins and proper recovery from spins. Then somebody decided that more people were killed as a result of such training than as a result of accidental spins. Whereupon, they stopped teaching students spins and spin recovery.

Now, somebody has suddenly noticed that quite a large number of supposedly well-trained pilots are killing themselves as a result of accidental spins… probably because they do not know what to do if an accidental spin occurs; never having been taught the proper procedure.

In such instances, it is almost impossible to come up with anything even approaching a reliable set of statistics… and I will personally be very surprised if any meaningful statistics are ever produced to indicate the actual value of exercise for the purpose of preventing injuries. Therefore, in such cases, we must simply rely on common sense, self-evident truth, obvious fact… call it what you may.

An injury occurs when a force is imposed upon a muscle (or a joint) to the degree that the force exceeds the breaking strength of the body part, the muscle or joint. That much is undeniable… and thus, it follows that the injury would not have occurred if the breaking strength had been greater than the force.

If a rope has a breaking strength of 100 pounds, then it will not break as a result of 50 pounds of force. But if its breaking strength is only 40 pounds, then 50 pounds of force must break it.

A coach can do little or nothing to reduce the forces that will be imposed upon his athletes on the field. But, he certainly can increase the breaking strength of their muscles and joints.

In some cases, the forces will be so great that no possible level of human strength would be high enough to prevent injury… but even in these cases, the extent of the injury may well be reduced as a result of exercise-developed strength. Thus, exercise will reduce the level of damage in many cases… as well as prevent injury in many cases.

So much for preventing injury… even in the lack of statistics to prove the value of exercise for the purpose of preventing injury, it is obvious that exercise does help prevent injury, and it also reduces the extent of damage in many other cases.

But we still need to look at the subject of avoiding injury. We need to be aware of the factors that cause most training injuries, the type of injuries that are directly caused by exercise. Almost all of these injuries could easily be avoided.

Again… such injuries result when the force exceeds the breaking strength of a muscle or a joint. Therefore, the force that is involved in exercise should be as low as possible without reducing the productivity of the exercise.

At first glance, this may appear to present a paradox… since exercise consists of exposing muscles and joints to force. But in fact, no paradox exists… it is easily possible to produce the maximum possible strength from exercise while avoiding at least a large part of the force that is usually involved in exercise. Unrequired force does absolutely nothing in the way of increasing strength, while causing almost all injuries that are a direct result of exercise.

Bad form, or style of performance is the culprit in almost all such cases… and this usually involves sudden, jerky movement. Jerking greatly increases the forces imposed on the muscles and joints.

But in practice, thousands of athletes train in what may well be the most dangerous manner… meanwhile believing that their style of training is quite safe. And… meanwhile they avoid the most productive part of their exercises under the totally mistaken impression that they are thereby helping to avoid injury. So they train in a dangerous manner, while considering it safe… and avoid a productive style of training because they wrongly consider it dangerous.

Most people are absolutely convinced that hard exercise is a dangerous exercise… and sometimes, in a few special instances, this may be true. But in most situations encountered in exercise, it is exactly the opposite of the truth… it is utterly false.

Remember… force causes injuries.

It matters not at all how hard it feels… all that matters is the force in relation to the breaking strength. Since we are never aware of the exact, momentary breaking strength… all we can do is reduce the force as much as possible while still working all the muscles as hard as possible.

And again there is no paradox involved, as the following example will clearly prove.

If an athlete walks into a gymnasium with the momentary ability to curl 150 pounds… and if he actually curls 150 pounds… then he will be working as hard as he can at that point in time… and he will also be producing maximum possible force.

And if it happens that the momentary breaking strength of his tendons is only 140 pounds… then he will injure himself. Under these circumstances, injury is unavoidable.

But instead, if the athlete used a barbell weighing only 120 pounds… and if he performed several repetitions with this lighter weight… and if the form was good and the movement fairly slow… then he would probably never produce more than 125 pounds of force, which would be *less* than the breaking strength of his tendons… and the injury that was unavoidable with 150 pounds is thus avoided.

During the first repetition with this lighter weight, the resistance would feel light… because, at this point in the exercise, the resistance would be well below the momentary strength level of the athlete's muscles.

During later repetitions, the same resistance would feel much heavier, much harder… but in fact, the weight has not changed. All that has changed is the athlete's momentary strength, which has been reduced as a result of the first few, seemingly light, repetitions.

And when he reaches the final repetition, it will feel very heavy indeed… but again, the weight remains the same.

In fact, if the exercise is performed from first to last in good form, then the actual force will be lowest in the final repetition because the speed of movement will be less at that point.

Therefore, the final, seemingly hardest, repetition will feel very hard… and it is probably only natural for people to feel that it is the most dangerous repetition, because it feels that way. But, in fact, it is the safest repetition in the exercise… because, at that point in the exercise the athlete is no longer strong enough to produce a force high enough to hurt himself, at least if he avoids jerking.

As a result of the widespread misunderstanding that exists in regards to these very simple points… misunderstanding that has probably resulted from the fact that nobody ever bothered to consider the involved factors in the light of physical law… most athletes avoid the final, seemingly hardest repetitions. Mistakenly they believe they are thus avoiding injury; when, in fact, all they are avoiding is the most important and most productive part of the exercises, and the safest part as well.

Exercise builds strength by exposing muscles to an *overload*… to a level of work that is beyond the limits of momentary ability, or, at least, well inside the existing level of reserve ability… far beyond the limits of normal activity.

But it is neither necessary nor desirable to expose a muscle to a maximum work load when it is fresh and strong… and doing so is dangerous.

If, instead, the muscle is pre-exhausted by the performance of several repetitions against a resistance that is well below the starting level of strength… then, later in the exercise, when a point of muscular failure is reached, the forces involved will be greatly reduced.

Upon reaching a point of momentary muscular failure, the resistance will certainly feel much heavier than it did at the start of the exercise… but that is merely an illusion produced by the fact that the athlete's momentary ability has declined to the point that he is unable to produce enough force to move the weight.

In the example given, involving a curl with 120 pounds, 125 pounds of force might have been produced during each of the first few repetitions… but at the end of the set, when movement is momentarily impossible, the athlete may be producing only 110 pounds of force, or less.

And, if 125 pounds of force did not hurt him… then 110 pounds of force certainly will not hurt him, regardless of how it *feels* at the moment.

The breaking strength of a muscle (or tendon, or joint) does not decline during exercise… it remains unchanged. All that happens is that an athlete's muscles become progressively weaker until they reach a point where it is impossible for them to continue with the available resistance.

If an injury is going to be produced by an exercise, then it will usually occur during the first few repetitions… simply because the forces are higher at that point in the exercise.

With the exception of weight lifters, athletes should *never* be required to lift as much weight as possible for a single maximum attempt repetition… such lifts are not required for building maximum strength, and they greatly increase the danger of injury.