



## **TIGHTENING UP YOUR TOLERANCES**

Remember the last time you bought a new car? The doors would open very quietly and they would shut without rattling. The engine ran smoothly and gas mileage was very good. The steering was responsive and the car would react as soon as you made even the slightest turn right or left. The dashboard looked great and there were no signs of wear and tear. Your car was running at peak efficiency and the engine made minimal noise.

However, as you used the car more and more, you noticed little things starting to go wrong. You began to hear a “creak” when you opened the driver side door. It also had a slight rattle when you would shut it. The steering was starting to develop a little “play” in it. There was this very slight noise coming from the engine when you started it in the morning...just a faint “tapping” noise. The acceleration wasn’t as good as it used to be. The car was running hotter than it used to, every now and then...overheating. You were even noticing a little smoke coming out of the tailpipe.

Your gas mileage had gone from 24 mpg when you bought it, to 16 mpg now. When you turned to the right sharply, you would feel yourself sink down a little as the right side of the car seemed to lift. There was this rattling sound coming from the glove box when you would get on a road that wasn’t perfectly smooth. The car seemed to ride rougher than it used to. The steering wheel seemed to “pull” a little to the left, as you applied the brakes.

You’ve seen this kind of thing before...the car is getting “worn out”! This happens to all cars sooner or later. The expensive cars usually don’t develop these annoyances as rapidly but sooner or later, they are still going to experience the same kind of wear and tear as the less expensive models. Given the fact that the car travels at high speeds, negotiates turns, goes over bumps and has to brake rapidly sometimes, it is only normal for these things to happen.



There is a saying in physics that goes like this “All things tend to disorder”. In other words, even if something is in order or...perfect working condition, through time and use it will tend to break down and/or become disorganized. Your car is tending toward entropy. The word ENTROPY is defined as, a measure of the amount of disorder or chaos in a system.

If these things are allowed to continue for prolonged periods of time, other areas of the car will become stressed and eventually break down. You see...the tolerances between moving parts and even non-moving parts, are loosening. When the car was new, the tolerances were as tight as they were going to get. All of the parts were moving together as a team, they were taking the correct paths and the car would run much cooler because there was less heat generated by parts that now grind against each other, increasing the amount of friction. Increased friction causes more heat, which means energy loss.

The amount of heat generated in an engine is proportional to the amount of energy lost in the transfer of energy. Each time you use the vehicle...the tolerances are loosening. The car will stay in better shape if you will address each problem, as it becomes known. Left uncared for however; loose tolerances in any one area, will start to break down all of the other parts in that area.

I'm sure you get the picture without me having to elaborate further. Let's think about how we can use this situation of the car getting worn out, to draw conclusions that may be applicable to the golf swing.

Some swings are great, when the person is young and the body is strong and has good flexibility. Time and much use though, will cause things to break down (tend to disorder) and the vicious cycle will get worse unless steps are taken to strengthen and reposition. As entropy increases, the efficiency of the object decreases.

We've seen it happen to the best of golfers toward the end of their careers. Remember how Byron Nelson and Sam Snead used to swing? Their swings possessed great timing and a smooth, unhurried tempo. They repeated those swings often and without pain. Many of us have seen these icons of golf, tee



off as “Honorary Starters” at the Masters in past years. While we may have commented that they still had relatively nice swings, in reality...they were nothing like they used to be. The point being, even the best of swings will break down over time.

What about the swings that were “loose” from the start? Remember now, when referring to tempo, “loose” is actually very nice. However, when referring to technical aspects of the swing and how parts work relative to each other, “tight” rather than “loose” would be desirable.

Many golfers have swings that have never been “tight”! Never at any time have they had an efficient motion that produced consistent shots with little or no wear and tear to the body. They might be able to shoot fairly decent scores but...it would depend upon them having exceptional timing because of the parts not working together, as they should. Even then, they will be inconsistent.

Those of us who teach golf, owe it to them to explain as much as possible...why it is not only beneficial to their scores but also to their health, to swing the club in an efficient manner. I have used this automobile analogy down through the years with good and sometimes amazing results. When a person can relate well to the analogy that you are drawing, they seem to gain a renewed interest and better understanding of the subject than previously.

I have actually seen students get very excited about working on things that used to be “very tedious” but now have become “challenging” since they gained a new perspective of the situation. It can be difficult for the average person to relate to certain words and/or terms that you may use when describing the golf swing if they have no concept of how it should work. Tell the average golfer that his tolerances are too loose and he might tell you that his personal life is none of your business.

Efficiency, tolerances, economy of motion, angular momentum, velocity, inertia, acceleration, centrifugal force, centripetal force, torque, lag, rotational inertia, potential energy, kinetic energy, transferring energy, axis, pivot, speed, lever, power accumulators, entropy...all of these are present in



the golf swing. These terms however, are not necessary to understand in order to play golf well.

In many situations, an understanding of these terms can even be detrimental to playing golf well. Some people can develop “Paralysis by Analysis” if they understand too much about what can go wrong in a golf swing. By the way, that is referred to as “The curse of a teacher”! We don’t need to explain terms like these to our students in an effort to produce better scores. Ignorance is bliss and can lead to better scores because of less tension.

However, it doesn’t hurt for them to understand that physics is at work in the golf swing and the more efficient we can become in swinging the golf club, the better odds we have of playing golf well. If we can get them to understand the example of an automobile and how it gets less and less efficient as it is used and that the rate at which it loses that efficiency is proportional to how parts are moving in relation to each other. They can start to see the importance of diagnosing swing problems through cause and effect.

When something gets out of correct position, let’s get it fixed as quickly as possible in order to minimize the damage. When teaching students how to troubleshoot their game, it is beneficial to explain that some parts move in direct response to other parts.

Let me use as an example, the crankshaft of an engine. Please keep in mind that by no stretch of the imagination am I a mechanic or even well versed in the workings of engines, so... I’ll try not to get in over my head. Please bear with me.

If the crankshaft is cracked, bent or in some way lacking the strength and shape in which it was manufactured, it will cause other parts to move incorrectly. As the crankshaft rotates around its axis, it causes the rods to move up and down. The rods, which are connected to the pistons, are causing the pistons to move up and down within the walls of the cylinders.

Compression, which in this case is necessary to create force efficiently, is partly maintained by the rings that encircle the pistons and actually slide



along the inside of the cylinder walls. The valves, which are at the top of the cylinders must move with correct timing relative to the pistons, in order to let fuel in, create a seal for the purpose of combustion and then let exhaust out.

Now, let's say that someone brings their car in for repairs because it is running badly. The mechanic sees that the rings are actually burnt and worn in an unusual manner. He knows that the rings need to be replaced but since they were worn in an unusual manner, he suspects that there is a deeper problem.

Upon looking a little deeper, he sees that the crankshaft is slightly bent, which caused the rods to not travel exactly vertical in their motion, which caused the pistons to experience more friction on one side than the other, which caused the rings to become worn in an unusual manner. I realize that it never gets this far because the engine would seize first since we are dealing with extremely tight tolerances and metal...stay with me though. He then tells the car owner that they have to replace the crankshaft along with the heads, rods, pistons, rings and other parts that were damaged because of the problem with the crankshaft.

If the person is willing to spend the money to fix the car properly, it will be expensive but the car will be almost as good as new and the person could expect to be trouble free concerning the problem that was just addressed. The person might decide though...to just buy a new car. Well, new cars can be obtained quite easily.

What about when our bodies get worn out...can they be replaced? I guess we've all seen that new (synthetic) hips and knees can be substituted for the natural ones that accompanied us at birth. I don't know to what extent the medical field can replace used worn out parts that are making it difficult for us to get around but it goes without saying, that unlike automobiles, we are pretty much stuck with the body and accompanying parts that we've had since birth.

Since we are stuck with just one body for the duration of our natural lives, I'm sure that we would all agree that it behooves us to take good care of it.



A body that is well taken care of will not only last longer, it will perform the tasks that we ask of it, with less pain and more efficiently.

Hypothetical situation:

Let's say that Bob comes to me for a lesson and states that he has been told previously that he has an "over-the-top" move in his swing and that his slice is the result of such a move. He also mentions that the last pro to work with him said that he should let his right elbow drop directly down to the right hip to start the downswing. The pro told him that if he did that, he would fix the problem and then be able to hit more of a consistent draw.

He then tells me that he has tried that but he hasn't experienced any measurable success and in fact, his ball striking is even worse now. He also comments that making that move seems terribly awkward. Upon videotaping his swing, I confirm to him that he does have an "over-the-top" motion in his swing and that the last pro was correct. He would fix the problem of the "over-the-top" move and hit more of a draw if he could let the elbow drop down to the right hip to start his downswing.

For a brief moment, before I say anything further, Bob gets a frustrated look on his face and then says, "So I just need to keep trying to drop that elbow down to the hip to start my downswing"? As if to say..."I've been doing that for weeks now, with no success and now you just tell me to do the same thing that other pro told me".

This fellow is frustrated and might be starting to feel like he just doesn't have it, when it comes to golf! Many people do get that way...right? Are they correct? Could be but I would say that the chances of that are very slim. Golf is a sport that can be enjoyed at any level, as long as the person feels some sort of accomplishment or fulfillment for their time spent in playing and practicing. What they shoot does not necessarily affect their enjoyment as long as they let themselves enjoy the moment, the golf course, their playing partners, the exercise or maybe just the fresh air.

When frustration starts to dominate the mind though, their days in golf are numbered unless they can get that excitement back. In hopes of reaching



that point again, many seek out a golf pro to fix the aggravating problem in their swing...that everybody seemed to notice well before they did.

However, because many people are given remedies to their swing faults, that are addressing symptoms or effects, rather than the underlying cause, they soon get so out of whack that they lose faith in the golf professional in general. Then they go back to their old habits or simply give up in an effort to get rid of that frustrated, defeated, embarrassed feeling they've been having lately while playing with their buddies.

The pro might simply tell his buddies that that person is just too uncoordinated to play golf and should stick with a sport that doesn't require such a blending of the mental and physical attributes. That way, he gets himself off the hook for not being able to help the person...or so he thinks anyway.

Let's get back to Bob! Remember that frustrated look on his face? "Bob", I say...'that other pro was correct in his remarks about what you could do to fix your problem. I would like to explain some things further though, so you can see where all of this originates". I ask him if he has any understanding of how an internal combustion (typical automobile) engine works? He says, yes...and that he has worked on them occasionally in the past. Great...now I have an avenue in which to better communicate with this fella.

After mentioning the crankshaft and all of the things affected by it, I tell him that he has the same type of things happening in his swing. Can the piston travel along its correct path if the crankshaft is moving improperly? Humans are not made up of metal and our tolerances are not as tight as typical machinery but...if an inner part is moving incorrectly, anything more on the periphery, is going to have a predisposition to move incorrectly.

I explain to Bob that if we merely address the action of the right elbow, he is going to be incorporating a compensatory move that adds another variable to his swing. You see, the root problem in his case, was that after setting up correctly, he was dropping his head substantially during the backswing and therefore increasing the tilt of his spine from its original position at address. This was causing his arms to move to a very upright position, which gave his



right elbow the predisposition to lift at the top, pushing his hands over his head.

From there, it would be a natural move to push the right arm and shoulder out towards the ball because of the angle of the right forearm being more horizontal than vertical. This is going to cause him to put extra stress on the spine, neck, shoulders, right elbow and wrist at the minimum. Additionally, it would be very awkward to let the right elbow drop into the right hip to start the downswing since the right forearm is closer to horizontal at the top, than vertical.

Depending how he compensates from there could add stress to many other parts of the body, which in effect, drains the mechanism of energy and prematurely wears those parts out. If he correctly understands the operation of individual parts in an engine, he will be able to have a better picture of what is going on in his body. I want to make sure he understands that each time he swings the club with his current habits, he is wearing down his body because of stress in places that are not supposed to bear that amount of stress.

It would also be beneficial to explain to him that if we can get the spine to maintain its original tilt from address until well past impact, that we are going to give the other parts the predisposition to move in a correct manner. The tolerances between parts are now going to get much tighter as they start to move with the correct paths relative to each other. This also means that energy will be transferred much more efficiently. The ultimate goal would be to have tolerances that are as tight as possible.

If, in the golf swing...each part moves in direct relation to the movements of other parts and into their correct positions, we will have tolerances that are very tight. The swing could then be described as “simple”, “repeatable”, “not timing dependent”, “easy to repeat under pressure”, “effortless” and so on.

Swings, in which the spine angle shifts constantly, end up having numerous other parts that are out of position and consequently, can be referred to as having too much “slack”! These swings can be described as “timing



dependent”, “having loose tolerances”, “difficult to repeat under pressure”, “jerky”, “out of balance” and so on.

A philosophy that would be beneficial for us as teaching professionals...would be to pattern our instructions around creating swings that are “SIMPLE”! If it is a swing that has much compensation, we should always direct our efforts to “SIMPLIFY”...never complicate. Using analogies is for the purpose of helping the student to understand things that may have been too difficult to understand when explained in a manner that only involves the golf swing.

It may seem that we are complicating things by explaining the intricacies of an internal combustion engine. Actually, it is for the purpose of helping them to see the importance of getting to the source of the problem, understand what the original problem can create and then simplify the swing so that it will become more efficient and easier to repeat. Remember when a person understands an engine better than they do the golf swing...you are simplifying by referring to the engine in order to help them get a clearer picture of how the swing works.

Let’s get back to Bob one more time. After hearing the explanation of how we must get to the source of the problem when working on an engine, he comments that he has never heard it put that way. “Why...all anybody ever said to me was that I was starting down from the top incorrectly. No wonder it felt so awkward to make the move that was being suggested, I was out of position to make that move”.

“So”...he says, “all I really need to concentrate on now, is keeping my spine angle constant from address, through impact until my hands are about waist high”? That’s right Bob! Let’s get the source of the problem fixed first. After that, we can start to address other habits that exist primarily because of the inconsistent spine angle that was causing the arms to get way out of position, which was compromising your balance, which created tremendous “slack”, which was making it terribly difficult to have a repeatable swing.

By the way Bob...I have great news! In fixing the source, you will give the other parts, the predisposition to move in their correct paths. When we



finally get those areas fixed, they will want to stay fixed because there will be a force guiding them to move correctly. Future swing problems will tend to be minor, instead of major. Additionally, your back, hips, knees, ankles, shoulders, elbows and wrists will say a great big “Thank you”!

Lastly, keep in mind that we are always trying to simplify but...some swings have been grooved for so long, or the person has numerous physical limitations, doesn't practice enough or simply doesn't want to put in the work to rebuild his/her swing. Our teaching should be predicated upon the desires, goals and physical limitations of our students, not necessarily upon what we think they have the potential to accomplish.

We MUST become familiar with our student through verbal communication. Talking with our students and learning more about who they are, what they have knowledge of, hobbies they enjoy, sports they've played, physical limitations they might have and so on, will give us the information we need to communicate effectively. This will allow us to instruct efficiently.

Remember, knowing your student as an individual, learning what things they have interest in and understand, and setting common goals that you have both agreed upon, will keep the relationship healthy, enjoyable and the communication lines open.

Good golfing!

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