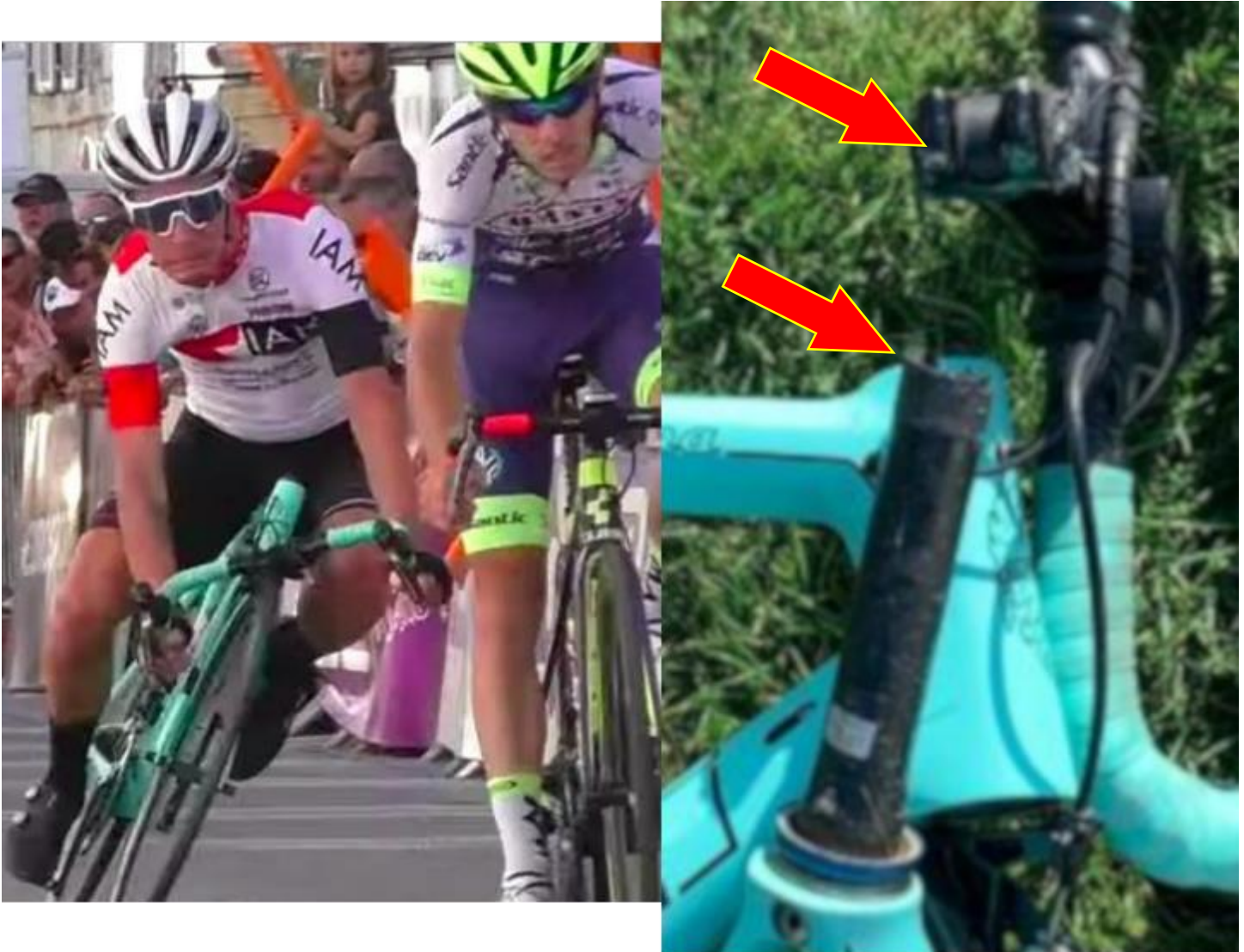


HOW TO PREVENT YOUR BIKE FROM KILLING YOU!

Simon Pellaud, in a recent 9/2019 French pro race, snapped his fork just below the stem. How did this happen and how can you prevent this from happening to you?

During a recent bike fit, a client wanted to invert his stem, changing it from '-10' to '+10'. Simple enough, just unbolt the stem from the handlebars and fork and flip it over. Luckily, by doing this revealed a hidden danger that many bikes are probably suffering from. In this article, I will take you through what I found and the process of how to fix it.

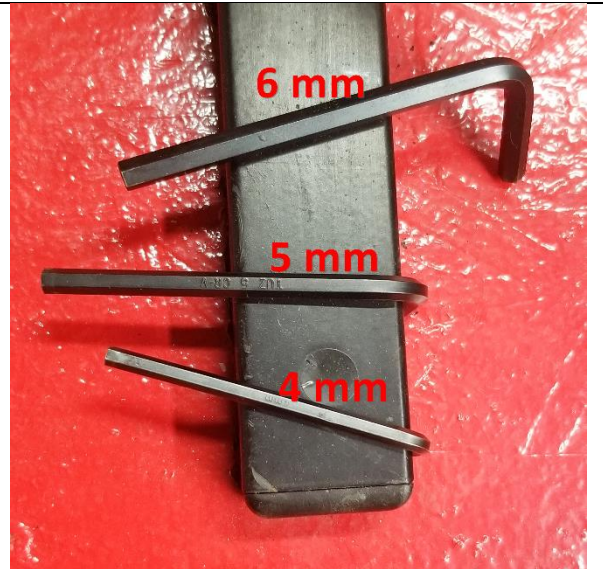
The photo below shows the instant the fork snapped and the condition of the bike after. You can clearly see that the fork snapped at the bottom of the stem. This is where to start the investigation.



As previously stated, a client came in for a bike fit. What I found was several issues;

- 1) Sharp edges left inside during the machining process of the **stem** caused concentrated stresses in the carbon steerer tube.
- 2) Excessively short stem expander plug did not allow any support for the forks steerer tube when clamping stem.
- 3) Overtightening of the stem coupled with #1, #2 above caused cracks in the fork steerer tube.
- 4) Same applies for carbon handlebar

The tools you will need. 4mm, 5mm, 6mm Allen wrenches



Start by removing the front wheel

Next, let's start removing the stem and fork.

In most stems I have seen, the top cap is 6mm. Unscrew all the way out making sure to keep it together along with any spacers that are between the cap and the stem.



Next, remove the front of the stem that holds the handlebars. In this case, I am using a 4mm.

As soon as I removed the stem cap, I noticed a BIG problem. Do you see it? Take a guess, will discuss later.

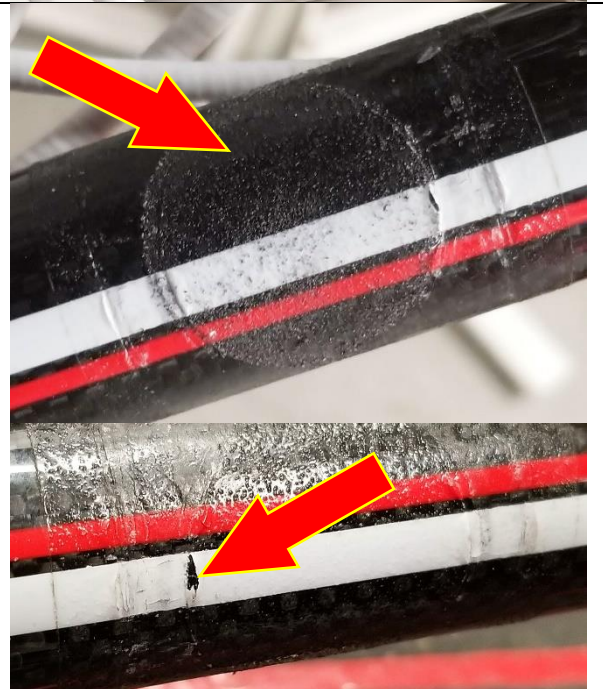


With the handlebar removed, let's inspect both front and rear of handlebar where it was clamped to the stem.

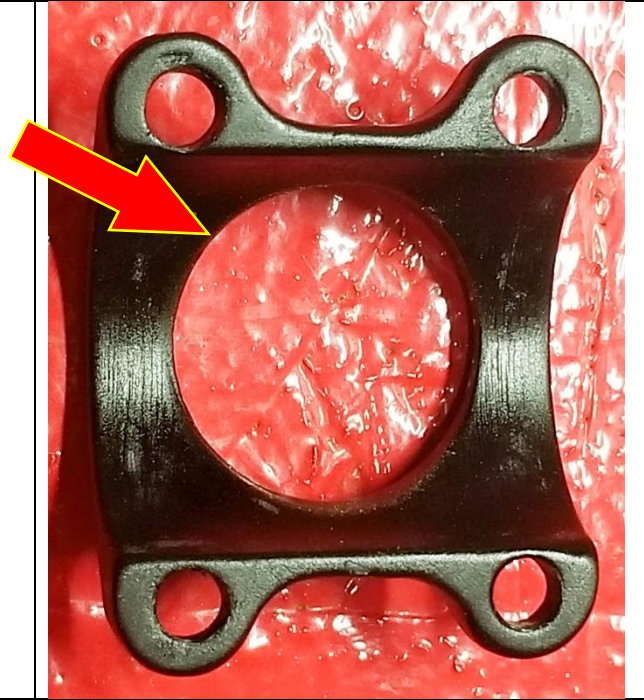
FRONT: Deep impressions in the carbon from the front of the stem.

REAR: Small crack developing.

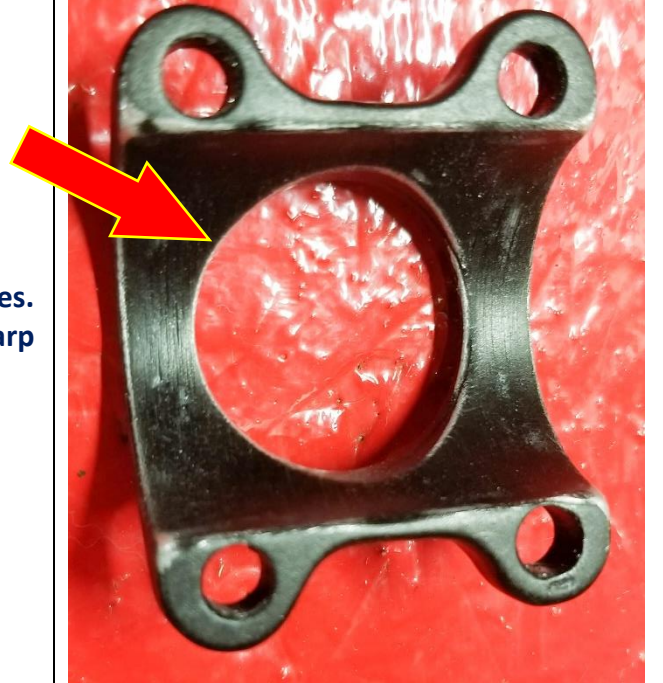
Both of these caused by stress risers in the stem from the machining process. Eventually, either could lead to total handlebar failure.



Here's the culprit. Sharp edges from machining.

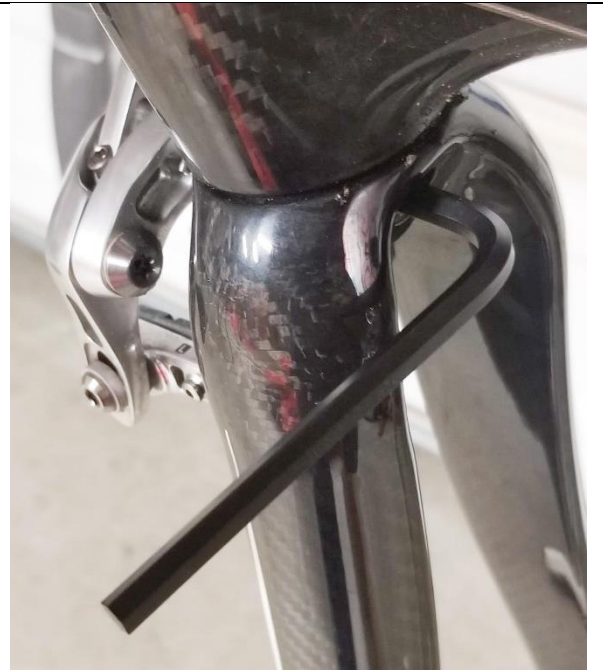


Here's the fix. 180-220 grit sandpaper smoothing ALL edges. Now this is completely smooth to the touch and not a sharp edge anywhere.



At this point, the fork is still held on by 2 stem pinch bolts (and to some extent, the compression plug).

Time now to remove the front brake. Most use a 5mm. Unscrew the caliper bolt located inside the rear of the fork and screw back on to keep it all together.



Next, while the fork and stem are still installed, let's take a look at the inside of the stem.

More sharp edges, time to sand.



Loosening pinch bolts and removing stem. Be careful to hold onto the fork so that it doesn't fall to the ground.



With stem removed, let's sand the insides. Smoothing the top, bottom, inside front, inside rear. Make sure you remove any stress risers along pinch bolts slot.



After sanding. Notice all burrs and sharp edges removed, nice and smooth now.



The real problem, hard to reach area along machined edge. Make sure you don't forget this area. Slip sandpaper inside slot so you can be sure to remove all burrs and sharp edges.



TOP: The inside edge from here to here was VERY SHARP and is what caused the crack to form.

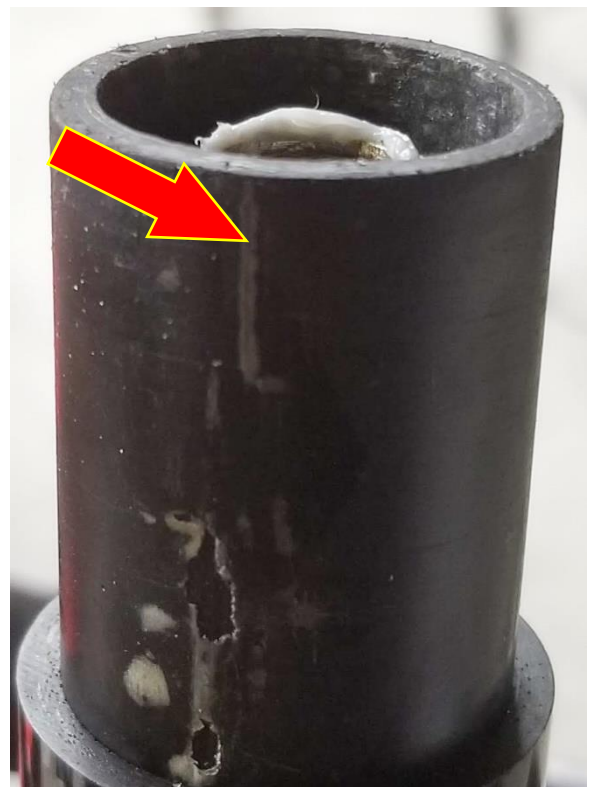
BOTTOM: Post sanding smooth as a baby's rear end!



Let's inspect the steerer tube

FRONT (top pic) – Deep impression where the sharp edges from the inside of the stem face plate 'etched' into the steerer tube.

REAR (bottom pic) – Crack starting caused by a VERY sharp edge at the rear of the stem along the right side of the pinch bolts.



Close up of crack starting, located to the right of the red lines. When I loosened the pinch bolts, I had difficulty using the short handled 4mm wrench. They pinch bolts were at least 10nM



Sharp Edge (stress riser) top right side of stem concentrated stresses here.



Next, Removing Fork by loosening and removing compression plug.



But first and as promised, let's discuss the **BIG PROBLEM**. This is the smallest compression plug I have seen. So small that there is absolutely **NO** support for the steerer tube from being crushed by the stem pinch bolts.

In fact, the compression plug was actually entirely below the bottom of the stem. Ideally, you want the compression plug to completely support the steerer tube along the full length of the stem.



This is about where the compression plug was located inside the steerer tube.



What about support from the top cap?

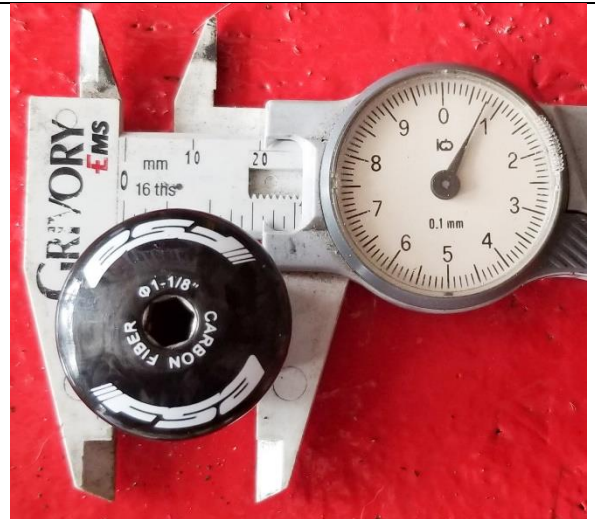


The inside diameter (ID) of the steerer tube measures 24mm



The outside diameter (OD) of the stem cap measures 20.75mm which is 3.25mm smaller than the ID of the steerer tube.

NOPE, no support here.



What makes a good compression plug?

A good compression plug for carbon steerers should provide full support from the clamping pressure of the pinch bolts of the stem. Also, provide enough grip so that the top cap can be used to adjust bearing pre-load. Good compression plugs are shown in photo #1 to the right. The knurled pattern allows grip and their long length provides physical support for the carbon steerer.

There are basically 2 types of compression plugs

1. Those for carbon steerer tubes – length is important
2. Those for steel steerer tubes – star nut design

NEVER USE A STAR NUT ON A CARBON FORK STEERER!

(unless using Cervelo's solution – see below)



Cervelo has, in my opinion, designed and built the best compression plug system for carbon steerers.

IMPORTANT: After the bike is built and the client has had a bike fit (important since there is no adjustment after the fact), the mechanic will apply EPOXY to a steel sleeve then slide it into the fork steerer. A star nut is already installed inside the steel sleeve. This provides 2 advantages;

- a) FULL support of the carbon steerer from the clamping pressure of the stem.
- b) Secure star nut grips steel sleeve providing non-slip grip when adjusting cap pressure.



Miscellaneous Photos showing more damage:

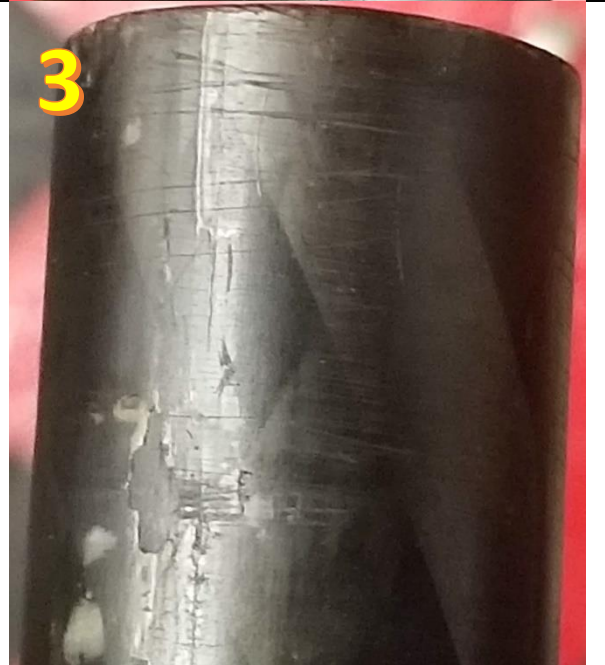
PIC 1 – Creases on steerer tube from overtightened Stem



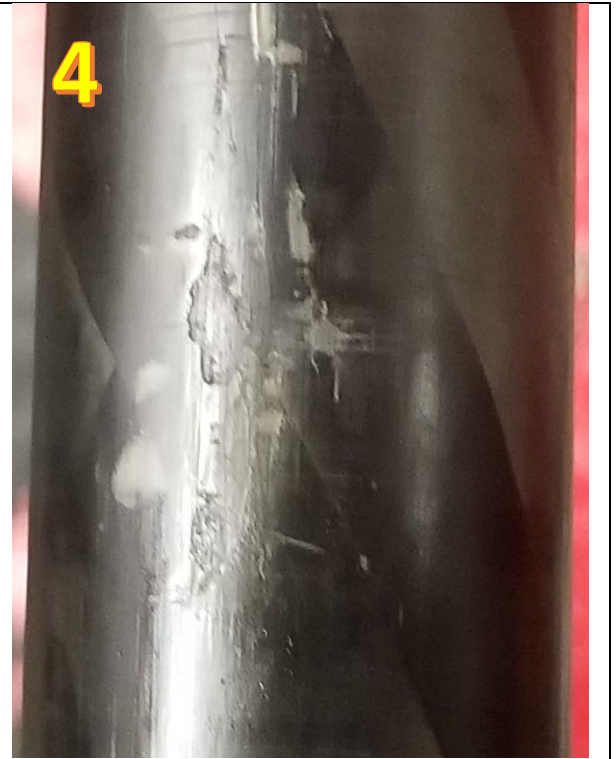
PIC 2 – Stem's sharp edges cut into carbon



PIC 3 – Damage from stem



PIC 4 – More damage from stem



Awaiting new fork, new handlebar.



Reassembly points (Important Processes)

See - <https://www.parktool.com/blog/repair-help/fork-steering-column-length-and-sizing>

1. Accurately measure new steerer tube
 - a. Tape measure, marker
2. How to cut steerer tube
 - a. Hacksaw
 - b. Hacksaw Blade 32TPI min
 - c. Saw guide
 - d. Vice
 - e. Tape
3. Torque wrench
4. Grease all screws