OlyBikes Chain Care, Wear, Skipping & Suck December 6, 2003
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The term "chain stretch" is misleading and wrong. Chains do not stretch, in the dictionary sense, by the
metal elongating through tension. They lengthen because their pins and rollers wear. This wear is caused by:

1. Lube failure
2. Road Grit

[Picture by Sheldon Brown]

Avoid oiling a dirty chain
When a dirty chain is oiled, or has excessive oil on it, this grit can move inside where it causes damage. Ideally, the chain should be cleaned of grit before oiling it. This is practically impossible without submerging the chain in a solvent bath. Cleaning devices can be clamped on the chain on the bicycle, and do a fair job, but do not prevent fine grit from becoming suspended in the solvent and entering the chain. Simply brushing or wiping the outside of a chain moves grit into the openings in the chain where subsequent oiling will carry it inside.

Do not use gasoline to clean the chain. It is explosive and its toxic petroleum fractions penetrate skin. Kerosene or a special degreaser is a better alternative. There are times when a chain is desperately in need of oil, but a good cleaning is not practical. In that case rule #1 may be violated to simply improve immediate performance. Keep in mind, though that it will not address all of the causes of accelerated wear, and may in fact, exacerbate them. It is notable that only an internally clean chain squeaks, so it isn't as

bad as it sounds – just lube it!

Removing the solvent from the chain after rinsing is important, otherwise you are dissolving any lube you apply. Compressed air can help remove solvent, as can a centrifuge (manually slinging the chain around outdoors works best if the chain is a closed loop but without pressing the pin completely in. The other way is to evaporate it. Accelerated drying methods by heating should be avoided, because they can be explosive if the solvent is flammable.

Motorcycle chain and chainsaw lubricants are better yet, because they have volatile solvents that allow good penetration for their relatively viscous lubricant. Paraffin (canning wax), although clean, works poorly because it is not mobile and cannot replenish the bearing surfaces once it has been displaced.

Swaged bushing chains

Sedis (owned by SRAM) was the first with its Sedisport chain to introduce swaged bushings, formed into the side plates, to replace full width steel bushings on which the rollers and pins bear. This design is stronger (side plates need not have the large hole for insertion of sleeves) and lighter than prior chains (no bushing). It achieves its light weight at the expense of durability, though (strength and durability are not the same). These chains have only vestigial sleeves in the form of short collars on the side plates to support the roller on the outside and the link pin on the inside.

The pins inside the older full-bushing chains were well protected against lubricant depletion because both ends were covered by closely fitting side plates (some motorcycle chains have O-ring seals at each end). In the swaged-bushing design there is no “continuous tube” because the side plates are formed to support the roller and pin on a collar with
a substantial central gap. In the wet, lubricant is quickly washed out of pin and roller and the smaller bearing area of the swaged bushing for the pin and roller easily gall and bind when lubrication fails. Disassemble a spare link of chain and see for yourself. [Picture by Sheldon Brown]

Chain Life

Chain life is almost entirely a cleanliness and lubrication question rather than a load problem. For bicycles, the effect of load is insignificant compared to the lubricant and grit effects. For example, motorcycle primary chains, operated under oil in clean conditions, last years while the exposed rear chains must be replaced often.

The best way to determine whether a chain is worn is by measuring its length. A new chain has a half-inch pitch (there is a pin at exactly every half inch). As the pins and sleeves wear, this spacing increases and this concentrates more load on the last tooth of engagement, changing the tooth profile. When the chain pitch grows over one-half percent, it should be replaced. By holding a ruler along the chain on the bicycle, align an inch mark with a pin and see how far off the mark the pin is at twelve inches. An eighth

of an inch (0.125) is a little over the one percent limit while more than a sixteenth is a prudent time to get a new chain.

New Chains Slip on Worn Cogs

Sprockets do not change pitch (distance from center to center of adjacent teeth) when they wear, only their tooth form changes. The number of teeth and base circle remains unchanged by normal sprocket wear.

A new chain often will not freely engage a worn rear sprocket under load, even though it has the same pitch as the chain. This occurs because the previous (worn and elongated) chain formed pockets in the teeth by exiting under load. A chain with correct pitch cannot enter the pockets when its previous roller bears the previous tooth, because the pocket has an overhang that prevents entry.

Without a strong chain tensioner or a non derailer bicycle, the chain has insufficient force on its slack run to engage a driven sprocket. In contrast, engagement of a driving sprocket, the crank sprocket, generally succeeds even with substantial tooth wear, because the drive tension forces engagement.

> **[HEY! Read that again, it explains why new chains slip on cogs damaged by a worn chain, but not usually on rings damaged by a worn chain.]**

Worn Chains Slip on New Rings

In contrast a worn chain will not run on a new driving sprocket. This is less apparent because new chainrings are not often used with an old chain. In contrast to a driven sprocket (rear) the chain enters the driving sprocket under tension, where the previous chain links pull it into engagement. However, because a used chain has a longer pitch than the new sprocket, previous rollers bear almost no load and allow the incoming chain link to climb the ramp of the tooth, each successive link riding higher than the previous until the chain rides above the teeth. The pockets in a used sprocket are small but they change the pressure angle of the teeth enough to overcome this problem.

Chainsuck

Worn chainring teeth may cause "chainsuck", however. This phenomenon is the failure of the chain to disengage from the chainring. As a result, the chain is carried clockwise on the ring until it either strikes the bike frame, over-extends the rear derailer cage, locking up the drivetrain, or, rarely, completely wraps around the ring and contacts chain links on the top run of chain (coming from the rear wheel).

Chainsuck is a serious problem. It can deform a chain, making it more likely for the rider to experience the problem or other drivetrain malfunction such as poor shifting, or rear derailer damage. More seriously, it could cause a weakened chain to break, potentially

injuring the rider. Finally, it could permanently damage a bike frame, and possibly destroy it!

Chainsuck is caused by the chainring teeth becoming deformed by use so that “pockets” form in the tooth “pressure faces”. Normally, the shape of the teeth allow the chain to be unloaded at the bottom of the chainring, so that the chain can properly disengage from them. When the pressure faces are worn, however, the “effective pitch” of the teeth is increased. This prevents chain at the bottom of the ring from being unloaded, so that there is greater friction between the it and the ring. Eventually, this mismatch in pitch can result in the chain not properly disengaging from the ring, resulting effects mentioned above.

Chainsuck may occasionally happen on brand drivetrains and drivetrain parts. For instance, a new chain with a smaller pitch will have a greater tendency towards chainsuck when paired with a worn ring. Sometimes poor material or manufacturing quality control of rings is the culprit. Rarely, chainsuck on a new ring may resolve itself if it is due to “flashing” on the teeth (which effectively make the teeth wider than desired) but this is rare – chainsuck is mainly an issue of pitch mismatch, that is, it is a “front-back issue” and not a “width issue”.

Chainsuck is often observed more with small rings than larger ones. A likely reason for this is that with fewer teeth and higher loads, smaller rings may wear faster than larger ones. Chainsuck occurs more easily with MTB's than with road bikes. The reasons for this are their smaller rings, generally longer rear derailer cages (which Brandt suggests effectively lowers the leverage the tensioning spring has to disengage the chain), and, conditions that allow grit to effectively increase friction between ring and chain making it harder proper disengagement harder.

Probably the best treatise on chainsuck can be found on-line at:
http://www.fagan.co.za/Bikes/Csuck/