Permanently High Cluster Vacuum Damages the Teats

Subjecting the teats to an undiminished suction effect even during the rest phase, increases the extent of damage to the teats. There are, however, ways to milk gently.

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Damaged hard teat ends with ringing and fronds (so-called hyperkeratosis) have become a widespread problem. The result is an increasing number of cases of mastitis which do not respond to treatment. One cause of this problem, which unfortunately has received too little attention so far, is that the teats are often subjected to a milking vacuum that is overly aggressive. It is not only the absolute vacuum level that matters but also the variation of the vacuum during the pulsation cycles.

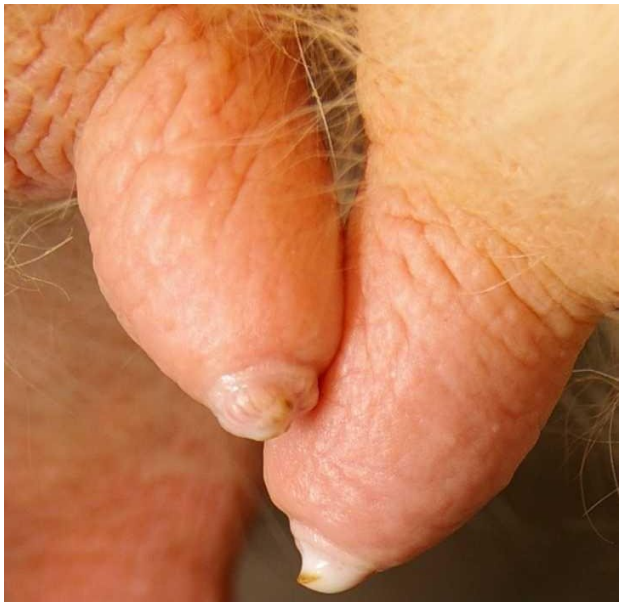
Milking more gently with a dynamic teat vacuum

During the suction phase, the vacuum in the liner should always be about 40 kPa, since this is the only way to achieve fast and complete milking. During the rest phase, however, the teat vacuum needs to be lowered to slightly below 20 kPa to allow the teats some rest from the stress of the preceding suction phase.

This strategy is based on results from scientific studies which show that a periodic lowering of the teat vacuum clearly has a positive influence on teat health. Studies from the University of Gießen and the Sächsische Landesanstalt für Landwirtschaft (Agricultural Institute of Saxony) show that milking with a lowered rest phase vacuum leads to less formation of rings at the teat end and to less damage at the teat end (hyperkeratosis), both with statistical significance. This is also confirmed by extensive research results of the Technical University München-Weihenstephan from the 1980s.

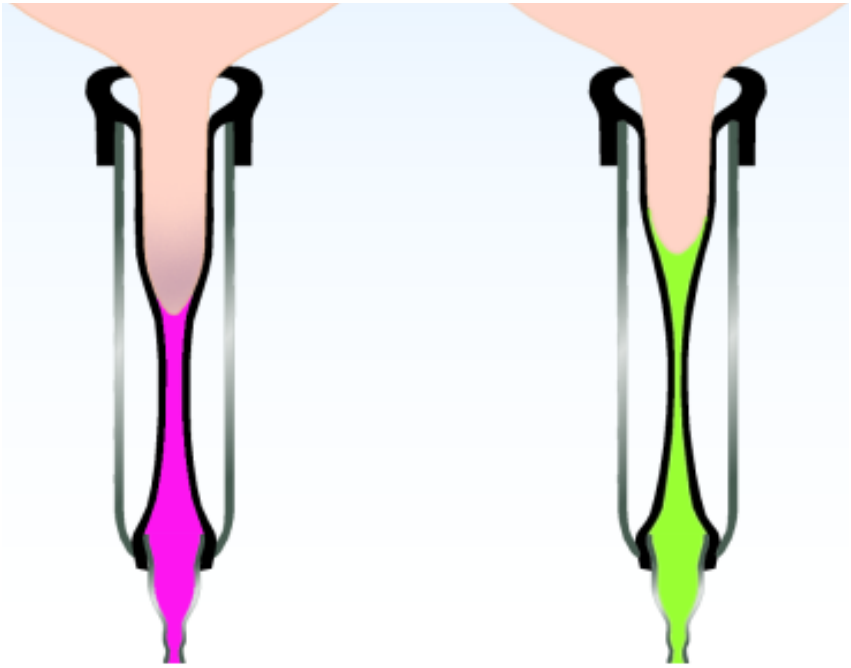
Treating the teats gently also has a positive influence on udder health (a lower rate of mastitis). Only intact teat tissue preserves the udder's infection barriers (see box). The advantages of a dynamic teat vacuum are based on the following facts:

- When the rest phase vacuum is lowered, the teats that were previously stretched can retract again. If, however, the vacuum at the teat is permanently high, the teats are stretched by up to 70% compared to their original length. This leads to considerable stress on the teat tissue.
- The temporarily reduced suction effect of the dynamic cluster vacuum allows unhindered blood flow. Undiminished suction, however, leads to increasing blood congestion in the teat ends in spite of liner massage. The teats swell and become sensitive to mechanical stress, such as the massage pressure.
- The targeted reduction of the rest phase vacuum also reduces the massage pressure the liner exerts on the teats. The decisive factor for the closure and massage pressure of the liner is the difference in vacuum between the exterior and interior of the liner barrel.



Scar tissue (hyperkeratosis) at the teat orifice is evidence of overly aggressive milking. The result: Destruction of natural infection barriers and frequent mastitis.

Contrary to widely held views, a massage pressure of more than 20 kPa is not necessary to completely push back body fluids that were previously aspirated. It is even harmful. High pressure on the teat ends is uncomfortable for the cows. In conjunction with stretched, swollen teat ends (see above) this pressure leads to damaged tissue.



In a permanent vacuum the teats are permanently stretched. Moreover, blood congestion occurs in the teat ends. If instead the cluster vacuum is lowered temporarily (right figure) the teats can recover from the stress of the suction phase.

Thin teats are particularly vulnerable

Tissue damage occurs especially in cows with thin teats because the sensitive teat duct is surrounded only by little protective connective tissue. Cows with a generally low milk flow rate, or with a low milk flow rate in single udder quarters, also suffer more from a permanently high teat vacuum than cows with a regular high milk flow rate.

The facts described further above are often denied because of these differences between individual animals. Based on the motto: „That can't be true. We use plenty of these clusters, and we don't have any problems.“

This way of reasoning ignores, however, that the problems do not only begin when the teats are visibly damaged, as in the case of massively frayed teat ends. Even an invisible hardening of the teat ends prevents the complete closure of the teats and promotes the invasion of pathogens. It also does not help the cow with sensitive teats that her mate with robust teats suffers less from the effects of the permanent vacuum. Thus it is generally necessary to use a milking technique that is as gentle as possible. This is particularly true since sensitive teats are already widespread and will become the norm in the near future.

In this connection, one should encourage the breeding organisations to change their approach. These changes in breeding policy, however, can only be realized slowly. Currently, one can, therefore, only advise the concerned farmers to use the available gentle techniques, especially since a permanently high milking vacuum is of no use at all.

Different solutions

The market offers different options. The difference between the options is in how much the rest phase vacuum is lowered, in their technical complexity, and in their susceptibility to failure. The following options are available:

- Milking with simultaneous pulsation: This relatively simple measure achieves a temporary vacuum-relief through the controlled formation of milk slugs in the long milk tube. This requires, however, claws and milk tubes of the right dimension and milk flow rates of at least 2 l/min. In addition, the milk tube has to ascend slightly close to the claw for several centimetres. Otherwise, the required milk slugs will no be formed.

Therefore simultaneous pulsation does not achieve an appreciable vacuum relief in conventional parallel milking parlours (“Side-by-Side”) or corresponding rotary milking installations. Completely in contrast to herringbone or tandem parlours and even more to high-line milking systems (stanchion barns, swing-over milking parlours). In the latter, simultaneous pulsation also has got a positive effect on the suction phase vacuum.

- Periodic ventilation: In fact, clusters with periodic ventilation, such as *Biomilker*, *Happel S90* and *Miele-MLT*, achieve the temporary vacuum relief by the formation of milk slugs. This is, however, only slightly affected by the milk flow and thus efficient. The above mentioned clusters have in common that their special valves admit large amounts of free air into the sight glasses or claws during the rest phases.

This results in a more marked and longer lasting reduction of the vacuum than is the case for standard clusters with simultaneous pulsation. Furthermore, the cluster vacuum is not subject to as many uncertainties since the claw volume and the tube diameter are matched to the incoming air volume by the manufacturer.

In practice, there are often problems with these types of milking clusters due to inadequate maintenance and milk flow sensors with a poor hydrodynamic design. However, if such unnecessary mistakes are avoided, these clusters with periodic ventilation are still a good alternative for gentle milking. An exception are here, as well as at simultaneous pulsation, conventional parallel milking parlours and corresponding rotaries.

- Interruption of the vacuum supply: The third approach for periodically lowering the teat vacuum is suitable for all types of milking installation, including conventional parallel parlours and corresponding rotaries. It is to interrupt the connection between the claw and the teat. This may not seem logical at first glance since the liners close during the rest phase. They do, however, not close completely. In reality, partial openings remain that allow the vacuum to spread unimpededly to the teats. This is also true for triangular or multi-sided liners.

A standard liner is never closed completely, not even during the rest phase. The vacuum continues to spread unimpededly through the remaining openings.

In order to close these openings, the manufacturer GEA (formerly Westfalia) has been offering since the 1970s a special liner insert, the *Vacustop*. With this liner insert, it is possible to achieve a sufficient vacuum reduction at the teat end, as long as enough air is allowed to enter at the liner mouthpiece. With a growing number of small teats, however, this condition is no longer met since the liners stick to the base of the udder as soon as milking begins.

To avoid such problems, the cluster *AktivPuls* uses an air vent in the mouthpiece and a calibrated air duct to allow a controlled amount of air into the liner. Furthermore the opening between the claw and the teat is completely closed during the rest phases. Together this allows for a consistent reduction of the rest phase vacuum to slightly less than 20 kPa. This reduction is largely independent of the anatomy of the udder and of milk flow.

In the AktivPuls, the patented angular bottom of the liner (right bottom) and the air vent (right top) allow for a controlled vacuum reduction at the teat end to a gentle 20 kPa during the rest phase.

Compared to clusters with periodic ventilation, the *AktivPuls* is less susceptible to interference and needs less maintenance because it does not have fragile valves. Good maintenance and regular changing of the liners are of course essential for this model, too.

This technology should not be confused with the ARS cluster manufactured by Boventis or the triangular liners made by Milkrite. These liners have air vents as well, but are

Hyperkeratosis: The Avoidable Precursor of Mastitis

Hyperkeratosis is the result of massive damage to the teat tissue. The damage is visible at the teat orifice in the form of callous rings of different size that are sometimes frayed. They arise as a result of an excessive excretion of the teat duct epithelium. Hyperkeratosis is generally caused by excessive stress on the tissue. In addition, there are other causes, such as dipping agents that dry out the skin, or extreme cold.

Even veterinarians do not always pay enough attention to these visible signs of tissue damage, especially if the thickness of the ring and the fronds are limited. That is disastrous. Even minor and moderate hyperkeratosis considerably impairs milk production and udder health. Scar tissue formation first leads to a narrowing of the teat duct thus impeding milk flow. This in return leads to a longer milking time with further stress on the teat tissue. German experts call this "erworbene Schwermelkigkeit", which can be translated as „induced hard milker".

Furthermore, hyperkeratosis harbours pathogens and facilitate their entry into the teats. This happens when the teats no longer close completely, even after a long time, because the callus rings (as well as the hardened teat ends) offer too much resistance for the sphincters. In the end, the damaged (chapped) scar tissue of the teat duct loses its ability to prevent invading pathogens from penetrating further into the teat.

Hyperkeratotic skin is thus not a minor blemish. Neither is it the so-called normal reaction of the teat tissue to machine milking. Hyperkeratosis is rather an unnecessarily widespread, clear sign of overly aggressive milking and of severe impairment of the natural infection barriers of the udder. Even minor hyperkeratosis increases the risk of mastitis by up to 40%!

not equipped with air ducts or blocking mechanisms. They are thus missing essential components for an efficient vacuum reduction.

Summary

Clusters achieving a reduction of the liner vacuum to slightly lower than 20 kPa during the rest phase definitely have a positive influence on teat health. This is not only documented in older and in relatively new research but has also been proven by the experiences made in numerous cases in practice.

Damage to the teats and resulting udder infections can be avoided with this method, especially for cows with sensitive (thin) teats and for cows with generally low or irregular milk flow rates.

There are several models on the market to achieve gentle milking. Preferable are both, well-maintained clusters with periodic ventilation (such as *Biomilker* & *Happel S90*) as well as clusters with special liners that interrupt the connection to the claw during the rest phase while letting in a controlled air flow at the same time (*AktivPuls*).