The importance of teat-end integrity on the risk of intra-mammary infections

Importancia de la integridad de la punta del pezón en riesgo de infecciones intra-mamarias

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Abstract

The interaction between milking machine and milking procedures, associated with risk of mastitis are discussed, with special emphasis on pre and post-milking routines. The importance of teat-end integrity to minimize bacterial infection is based on biological findings that have been integrated into practical farm milking routines and practices over the last few decades.

In general, when we talk about mastitis (clinical or subclinical) we are assuming that bacteria will cause it, because they account for the majority of mastitis cases seen in dairy farms. Following this logic, it is a known fact that for infection to occur, bacteria must penetrate the teat canal in order to cause an infection.

During lactation, penetration of bacteria into the teat canal occurs either during the prepping procedure before milking, during milking, or in the inter-milking period. In the dry-off and dry period, bacteria can enter through the teat canal and cause an infection if the teat canal is not properly closed. These different infection mechanisms are well known and risk management measures are widely recommended globally (www.nmconline.org).

Significant reduction of teat skin bacterial contamination is the best way to minimize risk of infection, both pre and post-milking. At the parlor, the pre-milking routine incorporates both physical and chemical means to achieve this, while also providing the stimulating effect to the cow for milking. The fore-stripping step helps flush out any bacteria residing near the teat sinus (and greatly aids the milker in identifying clinical mastitis cases). The pre-milking teat-sanitizing step (also known as —aka— ‘pre-dip’) relies on the use of an effective teat sanitizer coupled with adequate contact time to kill bacteria on the teat skin surface. Finally, the ‘wipe’ step aims ensure that soils are removed and the teat is dry before milking by means of a cloth or paper towel. Improper handling of teats before milking, and inadequate milker hygiene
will increase the risk of infection. After milking ends, it is recommended to immediately dip teats in a teat sanitizing solution (aka ‘post-dip’) that will kill any remaining bacteria left on the teat skin or in milk droplets accumulating at the teat-end. It has been suggested that the teat canal remains open for about 2 h (McDonald, 1975; Neijenhuis et al., 2001) until a newer keratin layer is formed and the teat canal is sealed until the next milking. Post-milking disinfection, with adequate amounts of emollients and other components will keep the teat skin well conditioned and with reduced bacterial contamination (López-Benavides, 2014).

Teat-end condition integrity can be affected in different ways, from the machine, environment, or products applied to the teat. Scoring systems for teat skin and teat-end evaluations were described previously (Mein et al., 2001). Changes to an undesired teat condition can last over a milking and up to several months, depending on the severity of the condition. Short term, machine-induced teat condition changes include machine settings (i.e. vacuum levels, pulsation rates), liners used, or milking management (i.e. over-milking, teat cup crawling). Teat-ends are also susceptible to chemicals, and may respond either favorably or unfavorably depending on what is used. For instance, the use of mild surfactants and adequate emollient levels can positively affect teat-end condition (López-Benavides, 2010). In addition, changing teat disinfectants in the milking routine will inevitably lead to a temporary change in teat-end condition, which may last from 2-4 weeks, depending on the product used (Bruno and López-Benavides, 2016).

During milking, infection may occur if there is reverse flow of milk. This is more likely to occur when liner slippages occur and when vacuum fluctuations are not monitored properly. High performance herds aim to milk as many cows as possible in minimal time. For example, a fast milking cow can yield 10 Kg/session in just over 3.5 min, while slower milking cows may take over 5 min to achieve the same yield (Smits, 2017). This requires that cows be properly stimulated so that no disruption in milk flow occurs and milking can end quickly. Interestingly, it is better for the cow to milk out quickly from the biological point of view, because the longer machine on-time results in callosity rings to become rougher (Neijenhuis et al., 2000). Nevertheless, there is a higher possibility of infection when milk flow rate is high (Grindal et al., 1991). If teat-ends are not well conditioned or harbor mastitis pathogens, reverse milk flow may occur and the mammary gland may become infected. Producers aiming to maximize throughput need to pay special attention not only to milking machine settings, but also to the proper stimulation of cows and to the integrity of the teat skin.

A clear association between teat-end callosity and clinical mastitis was demonstrated previously (Neijenhuis et al., 2001). Although it is more probable to see rougher teat-ends with pointed or rounded teat-ends compared to inverted teat-ends (Neijenhuis et al., 2001), there was no difference between different types of teat-ends and their infection status (López-Benavides, 2004). What is certain is that rougher teat-ends are more difficult to clean during the prepping procedure, as bacteria may comfortably survive in crevices of teat skin. In addition, teats with cracked or rough surfaces on teat-ends are likely to take longer to close after milking, making them susceptible to environmental bacterial infection. Field studies showed that quarters with higher (worse) teat-end scores were up to 14 times more likely to have a new intra-mammary infection compared to those with optimal teat-end condition (Gentilini et al., 2016).

**Conclusion**

A wealth of information on studies conducted over the last decades has identified key risk areas where bacterial infection is likely to occur in a dairy farm, including the lactation and dry period. Although the importance of maintain good teat condition was introduced almost two decades ago, producers have not fully understood the implications of inadequate teat-end integrity and how that affects the milking procedure and the incidence of mastitis. Practical technical information applied on farm should help the dairy producer optimize milk yield and udder health goals.

**References**


