rccp Revista Colombiana de Ciencias Pecuarias

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

Mario G López Benavides, PhD

Technology Manager Milk Quality Animal Health, DeLaval, Kansas City, Missouri, USA

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.

Resumen

La interacción entre la máquina de ordeño y la rutina de ordeno, y su asociación con el riesgo de mastitis es discutido, haciendo énfasis en la rutinas de pre y post-ordeño. La importancia de la integridad de la punta del pezón relativo a infecciones bacterianas está basado en hechos biológicos que a través de los años se han integrado en rutinas de ordeño y prácticas de manejo de ganado de leche.

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

Bruno DR, López-Benavides M. Changes in teat condition observed when switching pre- and post-milking teat disinfectants. In: Proceedings NMC 55th Annual Meeting, 2016; 186-187.

Gentilini M, López-Benavides M, Pinheiro, Martins C, dos Santos MV. Quarters with high teat end condition scores are more likely to have new intramammary infections. In: Proceedings NMC 55th Annual Meeting, 2016; 124-125.

Grindal RJ, Walton AW, Hillerton JE. Influence of milk flow rate and streak canal length on new intramammary infection in dairy cows. J Dairy Res 1991; 58:383-388.

López-Benavides MG, Williamson JH, Walters JB, Hickford JGH. Relationship between intramammary infection and teat characteristics. In: Proceedings of the New Zealand Society of Animal Production, 2004; 64:147-149.

López-Benavides MG, Hemling TC. Effect of iodine teat dips on teat end roughness. In: Proceedings 5th IDF mastitis conference, 2010; 110-113.

López-Benavides MG. Must know facts about teat disinfectants and their role in the prevention of mastitis in modern dairy herds. In: Proceeding British mastitis conference, 2014; 25-31.

McDonald JS. Radiographic method for anatomic study of the teat canal: Changes between milking periods. Am J Vet Res 1975; 36:1241-1242.

Mein GA, Neijenhuis F, Morgan WF, Reinemann DJ. Hillerton JE, Baines JR, Ohnstad I, Rasmussen MD, Timms L, Britt JS, Farnsworth R, Cook N, Hemling T. Evaluation of bovine teat condition in commercial dairy herds: 1. Non-infectious factors. In: 2nd International symposium on mastitis and milk quality, 2001; 347-351.

Neijenhuis F, Barkema HW, Hogeveen H, Noordhuizen JP. Classification and longitudinal examination of callused teat ends in dairy cows. J Dairy Sci 2000; 83:2795-2804.

Neijenhuis F, Barkema HW, Hogeveen H, Noordhuizen JP. Relationship between teat-end callosity and occurrence of clinical mastitis. J Dairy Sci 2001; 84:2664-2672.

Schultze WD, Bright SC. Changes in penetrability of bovine papillary duct to endotoxin after milking. Am J Vet Res 1983; 44:23273-22375.

Smits W. Mastitis prevention: Beyond barn and teat cleanliness. In: Proceedings international bovine mastitis conference, 2017.