

TEAT CONDITION SCORING - AN EFFECTIVE DIAGNOSTIC TOOL

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Introduction

Milking cows used to be about the cow-maid and the cow but for over a hundred years the relationship has become increasingly a three-some with the milking machine a most influential interloper. Thus problems with the milking process or mastitis have in many cases become dependent in many ways on the suitability of the milking system, the response of the cow, actually the teat, and how the milker manages these and recognizes the significance of the interactions.

The aim of milking is to harvest a high quality product efficiently to the satisfaction of all involved. This means minimizing the time the milker spends on the tasks, working in a safe and 'pleasant' environment and all to the satisfaction of the cow, especially meeting her welfare requirements.

The milking machine has been refined to milk swiftly and completely but with as much effort invested in selecting cows to meet the same objectives. Biology does provide limitations. Faster flowing cows are more likely to suffer new bacterial invasions of the mammary gland and develop mastitis simply because the teat duct becomes wider open and takes longer to close after milking. The risk of infection requires proper attention to hygienic standards including keeping teats clean, preparing teats properly including pre-milking disinfection, fore stripping and adequate stimulation, appropriate cluster take-off and proper post-milking disinfection of each and every teat after each and every milking.

All of these issues center around the teat and how the cow is affected by machine milking conditions, skin diseases, environmental impacts on the teat and, overall, teat management (Table 1). Teat Club International (1-6) has described a range of teat conditions and tolerable levels of less than perfect teats encountered in the dairy herd. The details required to diagnose problems and their causes may be a highly skilled task requiring a specialist. However, the person milking the cows is best placed to know teat conditions and changes in teat conditions. A whole lot of time after cluster take off may not normally be available to look at teats but occasionally time should be dedicated by the caring milker to knowing how well the cows tolerate milking and the whole environment. NMC is developing protocols for assessment of teats to meet the needs of regulator approval of teat dips, scientific assessment of milking systems but also guides to the professional milker. Some of the key methods and objectives follow.

Table 1 Teat conditions observable according to the cause of the problem.

Machine induced	Environmental	Infectious
Discoloration	Chapping	Pseudocowpox
Oedema	Mud sores	Herpes mammillitis
Congestion	Suckling damage	Cowpox
Wedging	Insect damage	Papilloma
Ringing	Other abrasions and cuts	Foot and Mouth Disease
Haemorrhaging - petechia	Weather damage	Vesicular Stomatitis
Haemorrhaging - larger	Allergic reactions	Ringworm
[Hyperkeratosis]	Photosensitization	<i>Staphylococcus aureus</i>
	Chemical damage	<i>Streptococcus dysgalactiae</i>
		<i>Arcanobacterium pyogenes</i>
		<i>Fusiformis necrophorum</i>

Methods

Machine milking creates changes in teats that are best observed on removal of the milking cluster, usually within 30-60 seconds. Some longer-term changes e.g. of the teat orifice, may also be observed prior to milking. However, teats may be bathed in milk during milking such that the skin is moisturized and any changes in skin condition are masked. The effect of environment and teat treatments are best observed prior to milking and prior to teat cleaning. If a barrier teat disinfectant is used then the product should be washed off first and so the effects of the full teat preparation must be taken into account.

Teats may vary in color within cow and certainly within a herd according to breed and to breeding. Black teats obscure most changes in teat color as induced by machine milking or any hypersensitivity in response to environmental factors or treatments. Black teats often appear to have drier skin as any minor flaking is more obvious than on a pink background. Teat skin condition scoring must take account of this. Most teats have some non pigmented areas that should be the primary areas to be examined.

Any part of the teat may be affected so observations should include the whole barrel and orifice.

When assessing teat condition, all lesions observed should be recorded. Few lesions and no infections should be found if good husbandry is being applied.

Scoring should be made with the aid of a light source as it is dark under the cow; using gloved hands; examining all surfaces of the teat; and recording data immediately. This is best done by an assistant or on audio tape. Scoring should record cow number, teat and only non-normal conditions. Some common conditions to be found are described below.

During assessments of teat condition observations are best made by comparisons between teats of any one udder and between cows in the milking string usually of similar age and stage of lactation. Cows within 7 days *post partum* should always be disregarded.

Parameters to Observe

Infections

The days of viral infections of teat skin are hopefully long gone with quality disinfectants eliminating pseudocowpox, mammillitis and the others. Bacterial infections may still occur where primary damage to the teat has occurred. Such infections, most commonly of *Staphylococcus aureus* or *Actinomyces pyogenes*, pose a problem as this is presenting bacteria likely to cause mastitis to the teat.

Environment associated problems

Any non milking-related color change is likely to be caused by irritation and whatever the source is of concern. Pink areas should be compared for reddening due to local irritation. This may be general or on specific areas. When general, it may be caused by response to chemicals. This may also be true on specific areas if the reaction is in response to a combination of effects e.g. UV enhancement of chemical effects. When found, the areas affected should be noted. Irritation in response to a teat product usually occurs within 2-7 days of first use. Occasionally the milker may also show signs of skin irritation, most prominently on skin on the inside of the fore-arms and on the face.

Skin dryness can be estimated but may be significantly biased if only assessed visually because black teats always appear drier. It is better scored by a friction test. Wearing surgical (latex) gloves the examiner should drag finger and thumb along the barrel of the teat with light pressure. Skin may easily be determined as

- Smooth (S), fingers glide over the surface;
- Slightly rough (SR) with some drag of the latex or
- Very rough (VR) when the latex puckers.

Teat chaps should be scored for extent (minor and severe/extensive) and position (usually proximal, distal or at the orifice). The extent may indicate duration of the problem. Chaps present as horizontal cracks but not vertical cracks, open or scabbed, following the natural transverse folds of the shrunken teat. They may occur more obviously on the anterior surfaces of front teats and the posterior surfaces of hind teats. The effects of a poor climatic environment on abraded teat skin induce chaps. Usually this is excessive drying of wet teats often caused by cold draughts and winds. Poor liners, used in excess of the recommended life and so having lost tension or having become rough, and over aggressive teat cup removal may also cause primary trauma.

Chaps should be absent as their occurrence indicates poor teat disinfection or use of an inadequate product, usually containing too little emollient.

Suckling by other animals, often newly calved heifers, of herd mates is not uncommon. Damage is more commonly observed on the newly calved animal at the first milking. Then the damage is usually caused by the dam's own calf. Suckling damage should not be observed or should be showing significant signs of recovery, if recently calved cows are disregarded.

The lesions resulting are similar to chaps but are vertical on the teat and not transverse. They are usually caused by teeth scraping the skin. Only record the presence or absence of such lesions.

Insects may damage teats in several ways. Biting species, including Stomoxinae, Culicoides midges, sandflies and mosquitoes may suck blood and leave puncture wounds. It is these wounds that are enlarged by the rasping mouthparts of muscids such as the headfly, *Hydrotaea irritans*. Other species may create larger, discrete wounds including the excision of tissue by the yellow-jacket wasp reported from Israel.

Any abrasions that occur are usually related to lying conditions and muddy/sandy soils. Cuts to teats are usually caused by hooves when cows are rising or lying down, often because the stalls are of incorrect size or hoof management is poor. At pasture, cuts are more likely to be caused by wire fencing. All herds usually contain one or more cows with some cuts or abrasions.

At least three types of weather condition affect teat skin. Cold winds on wet teats cause chaps (see above). Sun and frost cause direct effects.

Frostbite is not uncommon in very cold areas even in a dry cold. The likelihood of frozen teats depends both on the air temperature and on the wind speed. Frostbite may more usually affect front teats and distally around the teat duct orifice. Frostbite may occur when a drop of disinfectant freezes on the teat end. Teats may initially appear reddened or pale. When severe, a scab forms that eventually drops off to leave a raw teat end.

Sunburn affects pink teats and is less likely in pigmented teats and so some breeds rarely suffer. It is also most likely on easily exposed teat skin and so will be directional and not affect the whole circumference of the teat. Thus, it may affect the outside of teats on one side of the udder and the inside of the teats on the other side of the udder.

Machine related conditions

Some teats are noticeably red, either at the teat-end or over the entire teat, when the cluster is removed. Others may become reddened within 30-60 s of cluster removal. In extreme cases, teats become blue or already appear blue when the cluster is removed, indicating cyanosis.

Poor teat color after milking may be worse for short or slender teats. Color changes are exacerbated by overmilking, especially with wide-bore liners or tapered liners with wide upper barrels, unusually heavy cluster weight, high milking vacuum, faulty pulsation or mismatch between type of liner used and mean teat size within a herd.

Black teats must be excluded from any color-based evaluation. Changes can be classified according to the proportion of light-colored teats that, when examined within 1 min of cluster removal, are:

- Normal (pink)
- Reddened (part of or all the teat-end or barrel may be discolored)
- Blue-colored (part of or all the teat surface appears to be tinged with blue or purple).

Because the causes of reddened or bluish teats may differ, red and blue classes should be recorded separately. However, a further simplification is to combine the red and blue categories into a single category for analysis of Normal (pink) versus Discolored (red or blue-colored).

When examined after milking, the upper part of the teat may have a visible line or mark caused by contact with the liner mouthpiece lip. Alternatively or in addition, there may be visible swelling (with a palpable, thickened ring) in the unsupported area that was inside the liner mouthpiece chamber near the end of milking.

Factors commonly responsible for swelling around the top of the teat as a direct result of milking include: high mouthpiece vacuum associated with wide-bore liners; overmilking, especially with wide-bore liners or tapered liners with wide upper barrels; teatcup crawling; or liner mouthpiece lips that are unusually stiff or narrow in relation to teat size.

These effects can be evaluated according to the proportion of teats that, when examined within one minute of cluster removal, are:

- Normal (no ring, little or no swelling)
- Visible mouthpiece lip mark or “garter mark”
- Marked swelling or palpable thickened ring.

Pooling data into two categories, Normal (no or mild swelling or lip marks) or Swollen (marked swelling or thickening) is recommended to simplify the evaluation.

Many teats feel soft and compliant after milking and they contract when touched. However, some teats feel swollen or firm or, in extreme cases, hard and unresponsive to touch. Teats often look flat or "wedge-shaped" after milking. "Wedging" describes the (typically slight) flattened shape of the teat-end due to the compressive load applied by the opposing walls of a collapsed liner. Severe wedging which induces a reduction in teat end volume may result from hard liners, liners mounted under high tension, a prolonged D-phase or failure of the liners to open fully.

Factors commonly responsible for swelling near the teat-end include overmilking, use of wide-bore liners or liners with high mouthpiece chamber, high vacuum, pulsation failure, insufficient rest phase of pulsation or short A- and C-phases of pulsation.

Teat-ends can be classified by simple visual examination supported by manual palpation, as:

- Normal (soft and supple)
- Firm, swollen or hard, or severely wedged.

When examined immediately after milking, the external teat orifice may appear to be closed, slightly open or, in extreme cases, with a funnel-shaped opening about the size of a match-head. Factors linked with short-term, post-milking openness of the teat orifice include high milking vacuum, overmilking, design of liner mouthpiece, unusually heavy cluster weight, or high liner mounting tension.

Teat orifices can be classified, by qualitative assessment within one minute of cluster removal, as:

- Closed
- Open (more than 2mm wide or deep).

Machine-induced changes in the incidence of petechial hemorrhages or larger hemorrhaging may occur immediately or may take several days before becoming evident.

The orifice may be decorated by varying degrees of extraneous keratin arising from hyperkeratosis, colloquially known as callosity. For general screening the most appropriate classification system recognises marked differences in the callosity ring in five thickness classes and whether the ring is smooth or rough. The ring is not relevant to teat conditioning trials but the extent of roughness is important.

It is important to recognise that hyperkeratosis is not entirely a response to machine milking although poor milking conditions may exacerbate any degree present. The amount of hyperkeratosis varies with age of cow and stage of lactation so the length of milking time may be an important factor, certainly overmilking creates excessive hyperkeratosis. Some evidence is available that a genetic predisposition exists that may or may not be related to teat shape. Pointed teats have the worst hyperkeratosis and inverted teats rarely demonstrate any.

Hyperkeratosis may be wrongly diagnosed when barrier and high emollient content teat disinfectants are being assessed. These products dry slowly so that in some bedding and pasture conditions the orifice becomes covered in a sand or soil and disinfectant crust that feels and looks like orifice roughness.

Targets

Tolerable levels of 'abnormality' have been tightened from early estimates based on experience of scoring many teats in problem herds.

- Color: no more than 10% of cows with light-colored teats should have one or more teats that are visibly reddened (congested) or tinged with blue (cyanotic).
- Swelling at or near the top of the teat: no more than 10% of cows should have one or more teats with marked swelling or palpable rings.
- Swelling and hardness at or near the teat-end: no more than 20% of cows should have one or more teat-ends classified as firm, hard or swollen, or severely wedged.
- Openness of teat orifice: no more than 10% of cows have 1 or more teat orifices classed as open.
- Vascular damage: more than 5% of cows should have petechiations on one or more light-coloured teats.
- Teat skin condition: no more than 2% of cows should have open lesions (including chaps or cracks) on one or more teats.
- Teat-end hyperkeratosis: no more than 20% of cows have one or more teats that are scored rough or very rough and no more than 2% very rough.

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