A Field Topic

The Milking Machine as It Relates to Mastitis

DANIEL O. NOORLANDER

I. B. A., Inc.
508 W. 630 S., Orem, Utah 84057

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ABSTRACT

Recent studies in the field and in research laboratories indicate pressure changes within the system can cause bacterial laden milk droplets to be introduced into the teat during milking. If this evidence is confirmed, mastitis control will be difficult, if not impossible, until milking systems are modified to prevent this reentry of milk to the teats. Some independent agency should draft safety rules for milking machine design to reduced tissue damage and microbial recontamination of the teat orifice.

There is much evidence that bacteria-laden milk droplets can be introduced into the teat by pressure changes within the teat cup, claw, and pipe system of a milking machine. This was first suggested by Noorlander (7) when his research demonstrated that milking machines were a predisposing factor to mastitis. Later the feasibility of this mechanism was studied by jetting bacteria (2) and bacterial endotoxin (11) against the end of the teat after which signs of penetration into the teat cistern were found. Noorlander later found (5), by the use of transparent inflations and shells, that most inflations and many claws became flooded with milk during the milking process and suggested use of milk tube air vents to stabilize the vacuum and to prevent impact of milk droplets against the teat. A recent and complete study (10) demonstrated that use of machines with operating characteristics conducive to the impact of milk droplets on the end of the teat (irregular fluctuation of vacuum supply coupled with cyclic fluctuation at each pulsation cycle and fast opening of the teat-cup liner at the start of each milking phase) significantly increased the incidence of infection in teats challenged by dipping in a mixture of Streptococcus agalactiae and Streptococcus dysgalactiae.

Investigations of dairy herds having serious teat damage, teat erosions, and mastitis have disclosed that the damage to the end of the teat can be associated with liner design, pulsation function, cyclic vacuum drops measured below the teat, vacuum level, and wear or use-life characteristics of the rubber inflation (4,6).

Recent unpublished investigation of teat-end damage in Chile where many herds are still milked by hand, by modern pipeline installations, and a non-pulsating constant vacuum milking machine (8) demonstrated that vacuum can and does cause tissue damage, but the teat orifice damage reflected by teat erosions appear to be associated with inflation design and improper massage. Whittlestone made similar observations (12).

Experiences with several types of inflations including the Boumatic Triple Collapse, Flat or F1 and F2 liner; The P.V.C. Transparent liners; many of the Hi-Life narrow bore liners; and the Square Vented and Ring Type Square Vented liners sold throughout the United States show that liner or inflation design will influence teat damage, flooding of milk, milking efficiency and contamination of the teat orifice (9).

The speed of inflation closure and opening in combination with the type of claw, and inflation, are primarily responsible for the impinging of milk backward against the teat (10). The inflation bore size and milk tube outlet are also responsible.

IMPROVEMENTS NEEDED

Although most of the above technical information has been available to dairy farmers and milking machine manufacturers for many years, improvements in milking machine function has been primarily limited to improvements in vacuum pump capacity, air reserve, and lately vacuum controllers. This has helped stabilize the vacuum within the pipes of a milking system and helped prevent milk from impinging backward because of inadequate air reserve. However, little progress has been made to modify or change existing problems associated with the milking unit to prevent the impinging of milk backward against and through the teat orifice. Little has been done to improve inflation design to prevent tissue damage. Little has been done by manufacturers to prevent milk from being impinged backward against the teat because of pulsator, claw, or inflation design.

MANUFACTURING PROBLEMS

It must be remembered that most manufacturers have designed milking machines to solve labor problems. It was not until 1959 that dairymen were even exposed to the possibility that milking machines were a major predisposing cause of mastitis. Hol'ds Dairyman published a series of articles at that time based on the research done at the University of California. The same articles introduced the California Mastitis Test to dairymen (1).

It must also be recognized that manufacturers of patentable products generally do not publish papers on those products that could...
reveal to other manufacturers their trade secrets, formulations, or designs that would make their equipment function better than other manufacturers. Patented products are also a legal monopoly.

In understanding the mastitis problem one must also recognize that most dairymen in some parts of the United States still use milking machines that were manufactured or at least function the same as the machines that were manufactured before 1959. This is particularly true of the pulsator and inflation.

**WHAT KIND OF MACHINES DO DAIRYMEN USE?**

If the recent research results are true, it would appear that mastitis on a national or even international level will not be resolved until the milking machines now sold and used on the market are modified or changed to prevent bacteria from infecting our cows. The following are typical examples:

1. Most milking machines sold and used on the market cannot prevent bacteria laden milk from ejecting backward and into the teat orifice during milking (5).

2. Most pulsators used are very snappy in action. This means that most cows are milked with pulsators that cause droplets of milk to impinge backward against the teat (10).

3. Most inflations sold in the United States and the world restrict blood outflow at the base of the udder and are made of rubber with a high modulus of elongation. This is the physical force necessary to stretch rubber. Low modulus rubber is necessary for inflations 3/4 inch in diameter for proper teat massage and milk outflow (4).

4. Low modulus rubber used at the present time in narrow bore inflations does not maintain its physical qualities for longer than 1000 individual cow milkings and becomes very open and porous. Such inflations become a perfect place for bacterial growth (4).

5. Many claws sold or used in the United States and foreign countries cannot prevent milk from inside the claw from being forced backward against the teats of healthy cows.

6. Most milking machines cannot be sanitized properly between cows (4, 6).

7. Some dairymen are using inflations and pulsators that cause the cyclic vacuum to drop so low it is physically impossible for the inflation to close properly because of the use of high modulus rubber (3, 5).

8. One company sells vacuum regulators that cannot be adjusted. Cows milked with low lines are milked with vacuum levels that are 3 to 4 inches higher than when the same equipment milks into high pipelines.

**RECOMMENDATIONS**

In spite of the above observations and published reports from all over the world, there are universities and leaders in the dairy industry who would have one believe that these technological facts are controversial and one should not mention by brand name any component of milking machine equipment that may or may not predispose to mastitis.

New equipment is constantly placed on the market without prior determination of whether or not the equipment will or will not prevent milk from infected cows and equipment from ejecting backward against the teat. This is particularly true with some types of automatic take-off units that do not have automatic shut-off valves.

There is no mystery as to how or why vacuum damages the tissue of a cow. This was first recognized by Ivan Petrovich Pavlov who died in 1931. Louis Pasteur died 36 years before this and taught how to prevent the spread of disease by controlling infection. We have yet to learn to use these two simple principles in the design of our milking machine to prevent the dairy industry’s most costly disease.

It is suggested then, that responsible leadership within the dairy industry suggest and draft safety rules concerning the manufacture of milking machines to reduce the amount of tissue damage and bacteriological contamination to our dairy cows. This suggests, however, that funding and research for these safety rules be established by institutions that have no financial involvement with the manufacture of milking machines. These rules could be submitted to the consumer product safety commission under the Consumer Products Safety Acts passed by Congress in 1972. This Federal Act provides specific remedies and damages that the consumer, meaning the dairy farmer or cooperative, may enforce where he is injured or damaged as a result of noncompliance with this act. This act contains a provision for the submission of safety rules to the Public Safety Commission created by the Act.

It can be anticipated that the world’s supply of high quality protein will continue to diminish and no nation can afford the luxury of mastitis and it’s consequent effect on our milk volume.

**REFERENCES**

1. Holt, D., Mastitis can be licked now; You have to find it before fighting it; Getting the best from your milking machine. Hoard’s Dairyman, Mar. 10, Apr. 10, Apr. 25, 1959.
9. The author has been responsible for the design of most of these inflations. Design is limited to the type of rubber or thermoplastic compounds available at the time of design.


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