The Significance of Cluster Flushing in the Control of Mastitis

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It is well known that there are only three vectors that can spread infection from cow to cow during the milking process. These are:

- Hands
- Cloths
- Liners.

For many years we have stressed the importance of wearing gloves and the use of a separate paper towel for each animal. Control of infection from hands is based on the use of gloves. Of course gloves have no magic properties of their own; they simply allow hands to be disinfected more effectively. Hence it is very important to dip hands after milking a mastitic or high cell count cow. Cloths can spread infection and in the majority of parlour systems only one cloth per cow is used, but this still means that infection could potentially be spread from one quarter to another in the same cow.

The liners clearly represent the greatest risk in the spread of infection. This is because:

- when removed from the previous cow the liner commonly contains milk soil inside the liner mouth
- Liners come in contact with the whole teat rather than just part of it
- Liners are in contact with the cow for a longer period of time than other vectors
- In the majority of systems, the liners are not cleaned between cows.

The amount of milk held within the lip of the liner after unity removal is quite surprising. To check, simply place your finger over the short milk tube, put 20mls of milk into the liner (pic one), then hang it upside down in the position it would be in if it had come off the cow. Next lift the liner up into the air as if you were going to attach it to another cow. You will find that 2-3mls of milk will then run out of the base of the short milk tube (pic 2), even though the liner may have been hanging upside down for the previous five minutes. When this liner is applied to the next cow, the milk from the previous cow will run down the outside of the teat of the next cow to be milked, and if milk let-down has not been stimulated, this milk from the previous cow may spend 30 seconds, or a minute, bathing the end of the teat of the cow being milked. The consequences of this in terms of spread of infection are obvious.

Systems of Cluster Flushing

A system for the thorough cleaning of liners between cows should not only reduce the spread of infection from cow to cow, but it should also reduce BactoScans. Various systems have been used over the years and in the majority of parlours there is at least one system in use. The various systems are listed in the following:

1. *Bucket of disinfectant.* Originally hypochlorite was the most commonly used disinfectant, but this degrades rubber and is rapidly neutralised by milk. In recent years 0.2% peracetic acid has become more popular. There are two problems with dunking the whole cluster into the bucket. Firstly, when the whole cluster goes into the bucket there is no mechanism for the release of air, so the water only goes a short distance up into the liner. If you take a liner and put your finger over the short milk tube and push that into water you will find that the water only penetrates 4-5 cms into the liner (pic 3). The second problem is that continually dunking clusters into the same bucket soon leads to faecal and environmental contamination of the rinse water and this is then spread to the inside of the liners. The third disadvantage of the bucket system is that in a parlour with ACRs it is often necessary to disconnect the ACR clip cord before the cluster can be dropped as low as the bucket.(pic 4) This takes further time and labour and means it is less likely to be done.

2. *Jug and bucket.* Although it looks more complicated, the jug and bucket system has become quite popular. With this system, a jug of cluster flush solution is taken from the bucket and each liner is dunked in turn. This allows the air to be displaced from the liner, either into the claw or out through other liners, and it means that the flush solution goes much further up inside the liner. Each liner on a cluster is therefore flushed on an individual basis. Three or four clusters are flushed with each jug of solution, then that jug of solution is discarded, thus preventing further contamination.

3. *Manual Sprays.* Some parlours use a flush solution in a spray can, e.g. a small garden sprayer which squirts solution up into the liner. Our tests (described later)have shown that this has a significant effect, although it is surprisingly physically demanding pumping the spray can. An alternative system is to use the drop hoses that are available for washing badly contaminated udders. The tap on the end of these hoses is easily pushed and a much greater volume of flush solution can be squirted into each liner. On one of the farms using this system we obtained some of the lowest results of all farms tested.

4. *Air Wash.* Cluster flushing is certainly not new. Some 20 years ago one of our clients installed the Dutch air wash system (pic 5). The problem with this system was that it was so complex in terms of additional pipes and material on the outside of the cluster that the clusters became heavy and difficult to use. In addition, the flush mechanisms regularly failed to work.

5. *ADF, automated dipping and flushing*. This system, which was given an Innovation Award at the Dairy Event in 2006 ?, has become quite widely used on farms. The system uses its own specific liners and shells. An additional flush pipe enters the vacuum chamber of the liner adjacent to the short milk tube (pic 6). This pipe runs up on the inside of the shell and attaches to a small spray port just inside the mouth of the liner (pic 7). When the ACR mechanism is triggered, a squirt of dip comes through the liner port and this is applied to the teat. When the cluster is then hanging upside down, having been removed from the cow, a flush solution is squirted up inside the liner, followed by compressed air, followed by further flush solution. The big advantage of this system is that it is fully automated and that it provides both dipping and flushing. Many farms have this system in use and have been pleased with the results. However, there are some disadvantages. For the system to be installed, both specialist shells and liners have to be purchased. There have been occasions when the port inside the liner has become detached or starts to leak and flush solution is then released into the vacuum chamber. This is evacuated to the sanitary trap, which eventually fills and the safety ball shuts off the vacuum supply to the plant. All units then fall off! To be fair this is not a frequent problem however.

Personally I am also slightly concerned about the fact that the dip is only applied to the side of the teat, although I accept that it will run down and in most instances will cover the very tip of the teat. However, in some systems that I have monitored the ports on some teats become blocked or the timing of ACR removal and teat dip application has not been sufficiently synchronised and this then leads to teats being missed. In one or two farms that have used incorrect levels of sanitiser in the flush solution, there have even been reports of the milk failing the inhibitory substances test, but this must be a risk with any cluster flush system.

6. *The Vaccar cluster flush mechanism.*

The Vaccar system has a basic simplicity which makes it attractive, and uses the same cluster shells and liners that are already installed in the parlour. It is based on the use of sanitised water entering the long milk tube and then this is rinsed through and evacuated using compressed air. The flush mechanism is triggered by the automatic cluster removal. It supersedes other systems in that the flush solution enters the long milk tube (pic 8), often quite close to where the long milk tube enters the milk transfer line or the milk flow meter Two control boxes are installed at each milking point; one incorporates the compressed air and water solenoid valves, and the other houses the PCB which manages the system.

As with ADF, the Vaccar flush mechanism is triggered after the cluster is removed by the ACR. Firstly the vacuum is re-applied to sweep any residual milk from the cluster and long milk tube. Next, water or sanitising solution (0.75 litres) is introduced into the long milk tube, as close as possible to where the long milk tube enters the milk transfer line or the jar. The water is then followed by a blast of compressed air. This water/air cycle is repeated (giving a total of 1.5 litres per cluster of rinse solution), and finally a blast of compressed air removes any residual water or sanitising solution. The whole process takes around 30 seconds from the time the cluster is removed and so does not extend milking times.

The Vaccar system is suitable for use with most designs of parlour fitted with ACR's or Milk Meters, although the claws may need a simple modification

Farm Testing

Three commercial farms (G, M, and S) already using the Vaccar cluster flush were visited plus one farm (X) where there was a serious mastitis problem. On farm G the cows were housed, and udder preparation consisted of rinsing the teats in warm iodised water, but teats were not dried prior to unit application. On farm M the cows were still at pasture and udder preparation consisted of a dry wipe using a single use paper towel per cow. On farm S the cows were housed, and premilking teat preparation consisted of dry wipe. On all 3 farms the teats were visually very clean, and farms M and G had low bulk milk cell counts and Bactoscans. Farm S had only recently had the system installed and the cell count was high. On farm X clinical mastitis and Bactoscans were high, and at unit removal around 50% of cows had visual soiling of one or more teats.

Sampling Technique

To obtain results that could be used on a comparative basis between farms and between clusters it was initially necessary to establish a standardised the swabbing system. Farms were visited during normal milking and at least two rows of cows were milked, without any cluster flush mechanisms in operation, before swabs were taken. A single swab was rubbed up and down on the inside of each of the four liners three times, i.e. the same swab made three rubs inside each liner, and once into any milk or liquid which was hanging on the inner lip of the liner (pic 9). The swabs were refrigerated soon after sampling and remained refrigerated until the laboratory testing was carried out.

Laboratory Testing

Each swab is placed into 9.0mls Ringers broth to give a 1 in 10 dilution. 1.0ml of the solution is added to molten agar of three types of plate, one for total bacterial counts, one for Coliform counts and one for Staphylococcus aureus. The plates were incubated at 37^{o}c and examined at 24 and 48 hours post-inoculation. Colonies were counted and expressed at cfu (colony forming units) per millilitre of the initial Ringers broth. The figures therefore represent only the dilution of a standard swabbing technique. In no way do they represent the number of bacteria inside each liner. As the swabbing only covered a small area of the liner, the total number of bacteria within each liner (and therefore present to contaminate the next cow) would be very much higher.

Results

Sample results for individual cows and farms are shown in the attached Tables. The results show that all liners had a significant level of total bacteria, of total Staphylococci, of Staphylococcus aureus and strep uberis prior to flushing. Some of the liners were also contaminated with Coliforms, i.e. faecal organisms. A summary table gives the results from all 3 farms. Using the same sampling technique on a fourth farm (Farm X) where teats had been observed to be dirty, even after unit removal, gave very much higher bacterial numbers.

Conclusions

Cluster flushing showed a reduction in bacterial counts in all cases, and this must be of benefit to udder health and milk quality, although in this study no controls were available that might allow the reduced bacterial counts to be translated into benefits in udder health. However, in farm X, where there are 350 cows being milked twice a day, the introduction of manual liner disinfection 2 days after the results became available, was coincident with mastitis cases falling from 35 cows (ie 10% of the herd) in the mastitis group to only 5 cows (= 1.5%) within 2 weeks, and remained at this level for several weeks.

Practical Opportunities

We have found that this technique has generated great interest within our own practice, and it has given us the opportunity to become further involved with mastitis and milk hygiene. The technique has been used in the following situations

- to demonstrate that premilking teat preparation and teat cleanliness is less than ideal, and could be contributing to SCC or Bactoscan problems (in some instances this has been combined with a 'teat hygiene' score).
- to demonstrate the importance of the liners in the spread of staph aureus and strep uberis infections
- to demonstrate the effectiveness of the current cluster flush system in operation. For example, one herd compared a manual water flush with peracetic acid, and showed that although water was undoubtedly beneficial, the addition of acid produced further improvements.

This system is now available to other practices if they wish. If your clients are not convinced, simply ask them what is the point of applying contaminated liners to teats that they have only just cleaned prior to unit application!

Summary of mean values

Mean value per farm. Organisms (cfu/ml)	Farm M pre flush	Farm M post flush	Farm G pre flush	Farm G Post flush	Farm S preflush	Farm S post flush	Farm X pre flush
Number of liners sampled	36	36	16	16	36	36	12
Total bacterial count	5,966	48	8,275	87.5	2417	113	93,000
Total staph	3,755	3.3	475	17	197	<10	12,800
Staph aureus	256	<10	123	<10	33	<10	2,563
Coliforms	8.3	<10	22.5	2.5	57	<10	113
Strep uberis					230	<10	