

TO SEAL OR NOT TO SEAL: INTERNAL TEAT SEALANT STRATEGIES

Ann Wilkinson
Pfizer Animal Health
Atlanta, Georgia

Earlier this year, the first internal teat sealant, Orbeseal, was made available to US dairies. Although it is new to the North American market, it has been available abroad for several years, where it has been used primarily as an alternative to antibiotics.

Orbeseal consists of bismuth subnitrate formulated into an inert viscous malleable paste that does not have any antibiotic or antimicrobial properties. It is delivered in a tube and is infused into the teat end after drying off in a manner similar to infusing a dry cow antibiotic. After infusion it fills the fissures and folds of the teat canal thereby creating a seal preventing the entrance of pathogens through the dry period.

New IMI and the Dry Period

The rate of new intramammary infections (IMI) is significantly higher through the dry period compared to lactation, particularly during the 3 weeks immediately post-dry off and the 10 days prior to calving. Expression of these new IMI does not generally occur until after the cow has calved.

Research showing that many cases of clinical mastitis in early lactation stem from infections originating through the dry period includes:

- 52% of clinical coliform mastitis, through the first 100 days of lactation, stemmed from a dry cow infection. (Bradley, 2000)
- 61% of all new gram-negative IMI occurred while dry. (Todhunter, 1991)
- 51% of all new environmental streptococci IMI occurred while dry. (Todhunter, 1995)
- 56% of clinical mastitis cases due to *Streptococcus uberis* originated in the dry period.
- 33% of clinical mastitis cases due to *Streptococcus dysgalactiae* originated in the dry period. (Bradley, 2001)

International Internal Teat Sealant Data

The current Orbeseal product was developed in New Zealand to prevent new infections in low somatic cell count cows. Selective dry cow therapy is relatively common in New Zealand for a multitude of reasons, not the least being the overall lower average SCC. However, cows determined to be uninfected at drying off using sequential SCC reports of <200,000 and lack of clinical disease throughout the current lactation were noted to have an unacceptable rate of new IMI at calving.

The internal sealant available at the time was re-formulated to increase the concentration of bismuth subnitrate to 65% w/w so that the product would persist through the dry period.

Radiographs of 19 quarters taken 100 days after infusion with the new product show the seal is clearly in place. (Woolford, 1998)

The first published research study conducted in New Zealand concluded that the internal sealant was as good as a broad spectrum long acting intramammary antibiotic in preventing new IMI at calving and clinical disease through the first 5 months of lactation. (Woolford, 1998)

Orbeseal was recently licensed in the UK and many EU countries where studies support its use as an alternative to intramammary antibiotics in low somatic cell count cows. In one study the sealant was as good as the antibiotic in preventing new gram-positive infections at calving, but the sealant was significantly better in preventing gram-negative infections.(Huxley, 2001) A second study supported the approval of Orbeseal for use in organic herds in the UK. (Berry, 2002)

US Internal Teat Sealant Data

The first study looking at Orbeseal under US conditions has recently been completed and will soon be supported by the results of three more studies conducted in different geographies.

All the US studies are looking at Orbeseal in conjunction with a commercial dry cow antibiotic and all cows are treated irrespective of their SCC status at dry off. The inability to truly differentiate infected versus non-infected quarters at the point of dry-off and the high rates of new IMI at calving despite intramammary therapy are the main reasons for the dual infusions.(Cook, 2002) Current commercial intramammary antibiotics available in the US have a limited spectrum of activity against gram-negative organisms, and also do not persist until the time of calving, thereby leaving open a window of opportunity for environmental pathogens, particularly through the late dry period.

The initial Orbeseal study (Godden, 2003) was conducted at the Transition Management Facility, a joint effort between the University of Minnesota and two commercial dairies, comprising of approximately 2500 milking cows. Cows are housed in 4-row sand bedded freestalls from soon after dry off until approximately 12 days fresh and the facility focuses on transitioning cows seamlessly through the fresh period.

The objective was to determine if Orbeseal incrementally improved the udder health of cows already infused with cloxacillin benzathine (Orbenin DC). When infection status at dry off and LS at dry off were taken into account, overall quarters treated with Orbeseal were:

- 30% less likely to develop a new IMI through the dry period;
- 33% less likely to have a case of clinical mastitis; and
- 83% less likely to have clinical mastitis due to environmental streptococci when compared to quarters treated with an antibiotic alone.

Orbeseal quarters also had a significantly lower average LS.

Economics

Assuming a case of clinical mastitis in early lactation costs approximately \$200, payback is achieved by an absolute reduction of clinical mastitis of less than 4%. This is excluding the potential benefits of reducing subclinical production losses, attainment of SCC premiums, and potential improvements in reproduction.

The Godden study was conducted at the quarter level, therefore precluding a full economic analysis. The three additional studies have been conducted at the cow level and will provide material for investigating the financial benefits of reducing IMI.

Orbeseal is a tool to enable an improvement in udder health and the best results are likely to be seen where dry cows are housed in challenging environmental conditions. However Orbeseal is an inadequate remedy for substandard management practices.

Orbeseal Without Concomitant Dry Cow Therapy

Orbeseal has been used successfully in cows without prior antibiotic infusion. Careful selection of candidates is needed for this strategy to be successful, as Orbeseal does not have any therapeutic properties. A recent SCC of <200,000 and a negative CMT at dry off are reasonable proxies for the infection status of cows.

Care needs to be taken when any product is infused into the udder but especially so when Orbeseal is infused without antibiotics. The bismuth paste will thicken in cold weather and should be warmed to body temperature to assist with infusion, however the individual tubes should NOT be placed in a bucket of warm water.

The National Mastitis Council Recommended Mastitis Control Program includes the use of a dry cow antibiotic in all quarters of all cows.

Selecting High Risk Cows?

Theoretically cows that fail to form a keratin plug after dry off would benefit more from Orbeseal. A recent North American study supported previous New Zealand data by reporting that 50% of cows had open teat ends after one week dry and 23% of cows still had open teat ends 6 weeks after dry off. Nearly half (47%) of the subset of cows producing more than 46 lbs at dry off had open teat ends 6 weeks later. (Dingwell, 2003)

However, the Godden study found that the level of production at dry off did not impact the effectiveness of Orbeseal. Additionally, the infection status at dry off and the LS at dry off also did not impact the sealants ability to prevent infections at this site.

Dry cow therapy traditionally has had to fill two roles – prevention and treatment. This paradigm is now split with the internal teat sealant focusing on prevention. Technically all cows could benefit from prevention strategies, while treatment may be applicable to a few, particularly in herds with a low infection status and good control programs.

Core Antigens

The need for core antigens still remains as although a high percentage of new gram-negative IMI occur through the dry period, nearly 40% of the infections do occur while the cow is lactating. (Todhunter, 1991) The herds that participated in the Godden study were both using core antigen vaccines and so the improvement seen in the Orbeseal group was in addition to the benefits derived from both dry cow therapy and a mastitis vaccination program. Very few gram-negative organisms were isolated during the time the study was conducted.

Use In Heifers

The use of Orbeseal in heifers has not been formally evaluated at this time. Questions need to be answered regarding the timing of the intervention and the possible inclusion of an antibiotic. The ability to physically infuse heifers in a sterile manner should also not be overlooked.

Miscellaneous

Quarters will not explode if an infection is inadvertently “sealed” into the gland and antibiotic is not co-administered. The keratin plug has been sealing IMIs into glands for many years prior to the development of internal sealants.

Orbeseal should be stripped out manually prior to machine milking. Small flakes of the sealant may be seen on the milk filter for several days after calving and can be differentiated from mastitis clots by their texture.

Calves are able to remove the seal and safety studies have shown no adverse effects after the ingestion of bismuth subnitrate. Orbeseal therefore does not play a useful role in a Johnes control program.

It is important that the udder is not massaged after the infusion of the teat sealant.

Conclusion

The internal teat sealant offers another tool to combat mastitis by preventing new IMI throughout the dry period. The US studies are currently assessing the dual infusion strategy of Orbeseal in conjunction with an antibiotic, due to NMC recommendations and the KISS principle.

In certain herds, a selective dry treat program with the internal sealant protecting low somatic cell count cows may be a viable option. Extra care is needed however when infusing a non-antibiotic preparation.

As the data from the additional herds on study is compiled, additional herd specific strategies may be appropriate, relative to the degree of environmental challenge through the dry period.

That said, the dual infusion strategy has proven to be effective even in a well-controlled environment and it meets the objectives of a mastitis control program by treating existing infections while providing effective persistent prophylaxis. The overall benefits of this strategy include

improved udder health through early lactation, leading to long-term positive impacts on overall herd health.

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