COMPARISON OF VENTED MOUTHPIECE VERSUS BARREL DESIGN FEATURES FOR LIMITING MOUTHPIECE CHAMBER VACUUM IN TRIANGULAR LINERS

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Introduction

Over a quarter century of experience with triangular shaped barrel milking liners have shown them to have several desirable milking characteristics. Despite this, one of the drawbacks of a triangular shaped barrel is a tendency to have higher mouthpiece chamber (MPC) vacuums contributing to a higher prevalence of teat rings (2). Borkhus and Ronningen were able to demonstrate that barrel shape and design had a significant effect on the measured MPC vacuum (1). The goal of this study was to evaluate the effectiveness of liner design features that limit vacuum conductance to the mouthpiece against a conventional vented mouthpiece liner for limiting mouthpiece chamber vacuum in triangular liners.

Materials and Methods

Two triangle liners, Clover SR™ liners ("Liner A") with a 10mm short milk tube and IP3-LM-MV™ liners ("Liner B") were chosen for head to head comparison. Liner A was installed at stalls 13-24 and Liner B was installed at stalls 1-12 of a 2x12 parallel parlor. Using a #56 drill bit (1.18mm), a vent was drilled into the claws where liner A was installed, to admit approximately 12L/Min of air to the claw. Claws with liner B installed were not vented. Pulsation settings were 60 PPM and 65% A+B Phases. System vacuum was set at 13.3" Hg (45 kPa) with a peak flow claw vacuum average of 12.6" Hg (42.6 kPa). Peak flow vacuum data was recorded with a Tri-Scan II vacuum recorder (Cecomp Electronics, Libertyville, IL) and VaDia vacuum diagnostics units (BioControl Systems, Rakkestad, NO) were installed at stalls 6 and 18 to record the MPC vacuum over the entire unit on-time or attach duration.

Results and Discussion

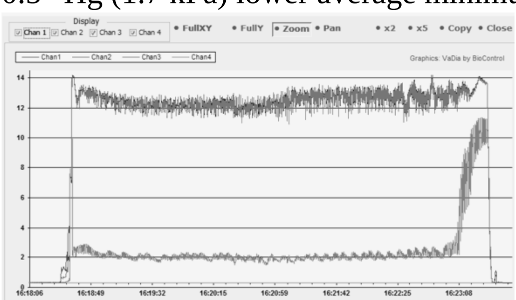
	Clover™ SR		IP3™-LM-MV		P-Value
	in Hg	kPa	in Hg	kPa	
Average MPC Over Unit Duration	5.8	19.6	3.1	10.5	0.0001
Average Maximum Recorded MPC Vacuum per Cow	10.9	36.9	11.0	37.3	0.8164
Average MPC During Peak Flow	2.3	7.8	2.5	8.5	0.6278
Average Maximum Recorded MPC Vacuum per Cow	3.7	15.9	4.5	15.2	0.1856
Average Minimum Recorded MPC Vacuum per Cow	0.8	2.7	0.2	0.7	0.0063
Average Peak Flow Claw Vacuum	11.8	40.0	11.6	39.3	0.1444
Average Maximum Recorded Claw Vacuum per Cow	12.6	42.7	12.5	42.3	0.6905
Average Minimum Recorded Claw Vacuum per Cow	10.9	36.9	10.4	35.2	0.0029

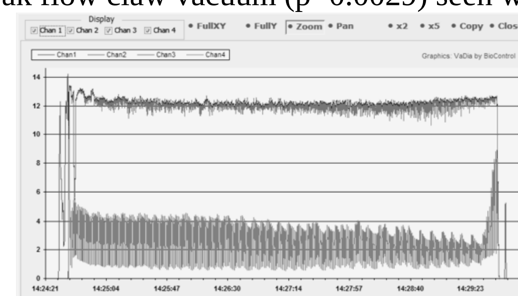
Thirty six peak flow MPC vacuum recordings were performed for each liner types. Peak flow was defined as occurring between the first and second minute post attachment and having a flow rate at or greater than 5 pounds per minute (2.27 Kg) at the time the measurement period was started. Only one recording was performed per cow, and this was measured on the right rear teat.

No significant difference in average MPC vacuum during peak flow conditions was found. Liner A held a numerical advantage of 0.2” Hg (0.67kPa) lower average mouthpiece vacuum during peak flow when compared to liner B, but the difference was not statistically significant (p=0.6278). Liner B minimum recorded MPC vacuum per cow was 0.6” Hg (2.0 kPa) lower during peak flow mouthpiece vacuum recording (p=0.0063).

Twenty nine MPC vacuums were recorded over the span of the entire attach duration for each liner. Liner B held a 2.7” Hg (9.1 kPa) advantage in average mouthpiece chamber vacuum when measured over the entire unit on-time (p=0.0001). Liner A held a numerical advantage of 0.1” Hg (0.34 kPa) lower maximum recorded mouthpiece vacuum when measured over the entire unit attachment duration. This difference was not significant.

The pictures below are representative examples of claw vacuum (top line) and MPC vacuum (bottom line) recorded over the entire unit duration. Liner A vacuum graph is on the left and liner B vacuum graph is on the right. There was a 1.4” Hg (4.7 kPa) difference (p= 0.01) in mouthpiece chamber vacuum fluctuation favoring Liner A. Liner B had a MPC vacuum signature of larger MPC fluctuation similar to a miniature liner squawk. Much of this is likely due to the large air admission of the four 10 L/min mouthpiece vents. This is supported by the 0.5” Hg (1.7 kPa) lower average minimum peak flow claw vacuum (p=0.0029) seen with liner B.





Conclusions

Using barrel design features to limit vacuum conductance to the mouthpiece chamber was equally effective at limiting mouthpiece chamber vacuum levels during peak flow when compared to mouthpiece venting. During periods of low flow (< 2.2 lbs. or 1 kg per minute) or no flow, when the teat is no longer filling the barrel of the liner, venting the mouthpiece has an advantage over liner design features in limiting average MPC vacuum. Mouthpiece venting produced larger vacuum amplitude in MPC vacuum throughout milking duration. For both liners, large variations in mouthpiece chamber vacuums appeared in many cases to be related to other factors such as shape and size of the teat and not consistently to liner design.

References

1. Borkhus M, O Ronningen. 2003. Factors affecting mouthpiece chamber vacuum in machine milking. Journal of Dairy Research. Vol. 70, pp. 283-288

2. Reinemann DJ, Gomez SM, Thomson PD, Ohnstad I, 2013. Exploring the role of liner dimension, shape, and venting on milking performance, Proceedings of the NMC Annual Meeting, San Diego, CA, pp.64-70