

# Two Independent Studies On KneeBinding Alpine Ski Bindings

## Executive Overview - Preliminary

### INTRODUCTION

Two independent studies, involving nearly 1600 participants at 13 ski resorts over 3 ski seasons, compared ski-related knee injury rates for resort employees skiing on KneeBinding Ski Bindings to injury rates for resort employees skiing on all other brands of ski bindings. The sample size included over 165,000 skier days. KneeBindings, with dual lateral release mechanisms (heel and toe), reduced the risk of all ski-related knee injuries by approximately 75% compared with other bindings.

### BACKGROUND

Six decades ago, ski bindings solved the problem of broken legs for skiers. The solution proved to be fairly simple – release mechanisms that could let your boot out before the forces were great enough to cause an injury – and they have proven very effective at reducing the risk of broken legs on skis. But these other ski bindings have never offered protection against soft-tissue knee injuries. For at least 30 years, this short-coming has resulted in 70,000 ski-related ACL injuries each season (1/3 of those in America), along with countless other (non-ACL) ski-related knee injuries. One out of three reported ski injuries is a soft-tissue knee injury.

*Other ski bindings have never offered protection against soft-tissue knee injuries. For at least 30 years, this shortcoming has resulted in 70,000 ski-related ACL injuries per ski season.*

Participation in skiing is significantly impacted by these injuries. In addition, ski resorts are subject to large worker compensation claims related to these injuries (one mid-sized ski resort recently reported *twelve* employee ACL injuries in just one season). Wells Fargo has stated that, on average, soft-tissue knee injuries account for nearly half of a ski resort's total worker compensation expense.

In 2009, KneeBinding of Stowe, VT began distributing alpine ski bindings with a patented, third release mechanism specifically designed to react to the forces known to cause most of the knee injuries in skiing, and to release before those forces could damage the knee. By 2014, the "KneeBinding" had developed broad distribution, and the early results were very promising. Yet, even today (in 2019) KneeBinding remains the ONLY binding that offers protection against soft tissue knee injuries.

## ABOUT THE STUDIES

Two independent studies were launched with a fairly simple goal: to compare knee injury rates for skiers on KneeBindings against knee injury rates for skiers who use other (non-KneeBinding) bindings. Each participating resort was asked to purchase KneeBindings to give to a group of employees (at no charge) to use for at least two seasons. Resorts were also asked to select a “control” group of employees on other bindings. Using HR/payroll systems and Worker Comp data, they were to track skier day and injury information for both groups while the employees were working. In addition, participants from both groups were asked to complete a survey reporting their skier days, injuries, and overall experience.



Vail Resorts enlisted Dr. Michael Decker (and others) of the University of Denver Biometrics

Lab and the Rocky Mountain Consortium to oversee their study, which took place at 3 of their resorts in the Colorado Rockies over the 2016/17 and 2017/18 ski seasons.

*“KneeBindings reduced the risk of all ski-related knee injuries by 75%.”*

Doctor Decker presented the results of the Vail Resorts study early in the spring of 2019 at the International Ski Safety Conference in Squaw Valley. The study is being submitted for journal publication by Michael Decker, Ph.D., Kevin Shelburne, Ph.D., William Sterett, M.D., Bradley Davidson, Ph.D., Human Dynamics Laboratory, U-Denver, Rocky Mountain Consortium for Sports Research, Edwards, CO, and Vail Orthopaedics, Vail, CO. This study found that KneeBindings reduced the risk of all ski-related knee injuries by 75%.

10 other resorts purchased bindings in order to participate in a 3-year study, and were asked to self-report their results retrospectively. This proved successful for most of the participating resorts (see the “limitations” section at the end of this report for an outline of inconsistencies). The combined data from the two studies included three Seasons (16/17, 17/18, 18/19), 13 Resorts (East, West, Midwest, Mid-Atlantic, and Canada), 1596 Participants (Patrol, Ski School, and Other) with 165,025 Total Skier Days (580 participants on KneeBindings with 59,102 skier days and 1016 participants in Control Group with 105,923 skier days).

Dr. Decker and his team are currently working to finalize the combined results for formal presentation and publication.

## PRELIMINARY RESULTS

Compared with the Control Group, KneeBinding Participants experienced a significantly lower incidence of knee injuries on skis, and a significantly lower incidence of ACL injuries on skis.

	KneeBinding Participants			Control Group		
	Injuries	Participants	Skier Days	Injuries	Participants	Skier Days
Totals	10	580	59,102	57	1,016	105,923
ACL Injuries	1	1 in 580	1 in 59,102	10	1 in 102	1 in 10,592
Other Knee Injuries	9	1 in 64	1 in 6,567	47	1 in 22	1 in 2,254
Total Knee Injuries	10	1 in 58	1 in 5,910	57	1 in 18	1 in 1,858

***People skiing on all other ski bindings were 5.7 times as likely to have an ACL injury as people who skied on KneeBindings.***

***KneeBindings reduced the risk of ski-related ACL injuries by 82.5%.***

## PRELIMINARY CONCLUSION

The results of these studies support the notion that a commercially available ski binding with a dual lateral release mechanism can reduce workplace injuries in the ski industry.

## PARTICIPANT SURVEY

In addition to collecting data from resorts, the study also conducted a survey of several hundred KneeBinding participants as a “cross check” and also to determine their opinions about the KneeBinding product. The response rate for this survey has been about 40%. Approximately 100 Control Group Participants were also surveyed.

Control Group skiers always skied on *non*-KneeBindings, and all of their injuries occurred on “other” ski bindings. Skiers in the KneeBinding group, however, also had access to skis with other bindings, and did not always ski on KneeBindings. Some resorts tracked this anomaly, and were effective in separating non-KneeBinding skier days and injuries out of the KneeBinding participant data. However, some resorts did not create this separation in their reporting.

The KneeBinding participants were surveyed about this to determine how much they skied on KneeBindings versus other bindings, and what bindings they were on when any injuries occurred. The survey results show that even fewer injuries occurred on KneeBindings than are reflected in the study:

Survey of KneeBinding Participants		
	KneeBinding	Other Binding
Knee Injuries	2	7
Skier Work Days	9,500	5,910
Injury Rate (1 per...)	4,750	844

***KneeBinding participants were 5.6 times more likely to injure their knees while they were occasionally skiing on other (non-KneeBinding) ski bindings.***

*- Participant Survey*

## SURVEY ITEMS OF INTEREST

Approximately 80% of the KneeBinding Participants who responded to the survey were male, and 20% were female. Approximately 20% of the KneeBinding participants who responded were under 50 years old. 28% of the KneeBinding respondents said they’d had at least 1 knee injury prior to 2016. 88% of KneeBinding respondents said they were type III or type III+ skiers.

KneeBinding Participants were also asked if they had experienced the “KneeBinding Lateral Heel Release,” and whether they believe they would have been injured if it had not released that way. 35% of responders said they had experienced one or more such releases. Of those, 28% said they believed they would have been injured if KneeBindings had not released sideways at the heel.

## USER EXPERIENCE SURVEY

KneeBinding Participants were asked to rate their overall experience with KneeBindings on a variety of criteria. For each category, they could choose ratings that ranged from “Poor” to “Excellent.” 93.9% of all responses rated KneeBindings “Good,” “Very Good,” or “Excellent.”

	Experience Ratings (Good to Excellent)			
	Instructors	Patrol	Other	All
Entry/Exit	87.8%	88.5%	88.1%	89.0%
Quality /Durability	97.6%	88.5%	97.6%	94.5%
Performance /Retention	97.6%	91.0%	100.0%	96.0%
Safety	97.6%	92.3%	100.0%	96.0%
Overall	97.6%	89.7%	100.0%	96.0%
All Answers	95.1%	89.7%	96.4%	93.9%

***93.9% of the time, KneeBinding participants rated their experience with KneeBindings as “Good” to “Excellent.”***  
*- Participant Survey*

### ADDITIONAL SURVEY LIMITATIONS:

1. Three KneeBinding participants reported 0 days on KneeBindings for all three season in their survey responses. After verifying that these individuals had not skied on KneeBindings, the three survey entries were excluded.
2. One Control Group participant completed the control group survey, but revealed he had switched to KneeBindings part way through the study. The Control Group survey entry was excluded, and the individual completed the proper KneeBinding participant survey.
3. The survey results for non-KneeBinding skier Days are consistent with previous studies regarding knee injuries throughout the industry.

## **STUDY LIMITATIONS**

As the study evolved, a number of variations arose within the study from resort to resort:

1. 13 ski resorts across the USA and Canada purchased bindings for approximately 800 on-snow staff members in order to participate in the overall study. Participation by individual resorts ranged from 50 pairs to 240 pairs.
2. This study ran for three seasons (2016/17, 2017/18, and 2018/19). Four of the 13 resorts participated in the study for two seasons (2016/17, 2017/18).
3. Three resorts provided KneeBindings only to ski instructors. One participating resort provided bindings only to Ski Patrollers. All of the other resorts provided KneeBindings to a mixture of instructors, patrollers, and other employees who ski as part of their jobs. Across all resorts, the approximate staff mix was 40% instructors, 40% patrollers, and 20% others.
4. Eleven of the thirteen resorts offered the bindings (and the mounting) at no charge to the employees. Two of the resorts subsidized the cost of the bindings, but also required employees to pay a small share of the cost.
5. Some resorts selected KneeBinding participants randomly, and some resorts allowed participants to “self-select.”
6. Three of the participating resorts defined an injury as an event that prevented the employee from working for at least one day after the injury or required medical attention and a subsequent worker’s compensation claim. The other resorts in the study defined an injury as an event that caused a worker’s compensation claim.
7. Some resorts were successful in identifying and tracking both their KneeBinding group and their control group, and were able to provide skier days and injuries for both groups. These resorts also provided email information for participants of one or both groups, enabling additional (survey) confirmation of the results reported by the resorts.
8. Two resorts distributed some or all of their KneeBindings without “enrolling” employees, and without tracking or reporting them. These two resorts were excluded from the final study results.
9. Two resorts have not yet reported injury information or skier days. The study results will be updated with this data if and when it is available. However, these resorts did provide contact information for participants, and these participants have been included in the survey.
10. One resort required all of its on-snow employees to ski on KneeBindings for all three years of the study (and is continuing to do so). This eliminated the possibility of a contemporaneous control group. In this case, the entire on-snow staff during the three years prior to deploying KneeBindings served as the control group, and the entire on-snow staff during the three years of the study served as the KneeBinding group.
11. Two resorts had a defined KneeBinding group, and used their entire non-KB on-snow employee population as their control group.
12. Some resorts reported all knee injuries, with ACL injuries as a subset, while some resorts only reported ACL injuries.