



Visual Correction of Kayakers with Consideration of Specific Conditions in Water Sports

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Introduction

Kayak sport athletes present a group which is exposed to special environmental conditions that can interfere with visual performance. To get a better conception about the special needs of the different disciplines in kayak sports, more detailed information about this group of athletes is necessary. Statistic analysis of correction methods for ametropia, experiences with environmental factors and consumer behavior should be determined.

Methods

For a prospective cross-section study a web-based survey with 19 questions was created. From August 2007 to January 2008 a group of 561 athletes with experience in different types of kayaking completed the anonymous questionnaire. The website (domains: www.kayakvision.com and www.kayakvision.de) was available in English and German. Additional information about correction and protection methods for kayakers, FAQs, "About us" and Imprint had been included.



Figure 1: Welcome page www.kayakvision.com



Figure 2: Presentation of Different Kayak Disciplines on website

The survey was comprised of 19 questions regarding the different aspects mentioned below. The answers were processed by click (accomplished by multiple choice, selection or scroll-bars).

Main target variables were:

- Age, gender, location (Europe, North America, other)
- Degree of professionalism (recreational or professional)
- Kayak-discipline (White Water vs. Flat Water)
- Importance of visual performance in kayak sports
- Assessment of visual performance during sport
- Presence/amount of ametropia
- Correction-method (everyday life vs. sport-situation)
- Initiator for correction-method
- Disturbing environmental factors during sport
- Loss of correction



Figure 3: Example page in online-survey

The data collected by the survey were evaluated by different statistical analyses (frequency distribution, median, mean, two-sample t-test, chi-square-test, ANOVA / p-value < 0.05 indicates statistical significance). The statistical evaluation of the ametropia distribution was made by power-vector-representation.

Results

The subjective rating of

Importance of visual performance vs. subjective assessment of visual performance during sport

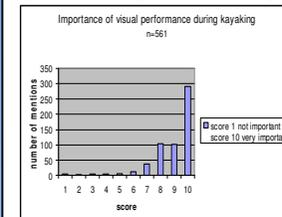


Figure 4: Rating of Importance of Visual performance

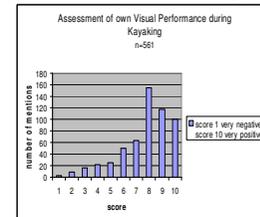


Figure 5: Assessment of Visual performance

The ratings show a significant difference ($p=2.44 \times 10^{-35}$, paired t-test).

Results of analysis of subgroups of ametropes:

- The contact lens wearers (lens type like in everyday life) rate their visual performance significantly higher than athletes with standard glasses, with special sports glasses and without correction ($p < 0.05$).
- There is no significant difference between contact lenses like in everyday life and contact lenses especially for kayaking.
- The non-corrected group rated the visual performance during kayaking significantly worse ($p < 0.05$) than all of the other ametropes wearing different correction methods.

Ametropia correction in everyday life vs. sport situation

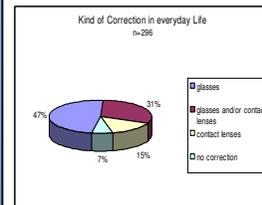


Figure 6: Ametropia Correction, everyday life

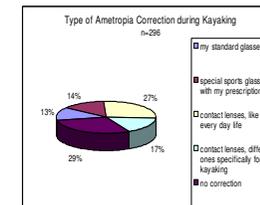


Figure 7: Ametropia Correction, sport situation

The percentage of non-corrected ametropes increased 4 times from everyday life (7%) to kayaking (29%).

Results of analysis of subgroups of ametropes:

- The amount of ametropia in the non-corrected group is significantly lower than in all ametropes ($p=0.021$).
- The amount of ametropia in the non-corrected group during sport is significantly higher than in the non-corrected group in everyday life ($p=0.024$).
- The highest proportion of non-correction athletes is present in the professional group which differs significantly from the recreational group ($p=0.00023$), (Figure 8).

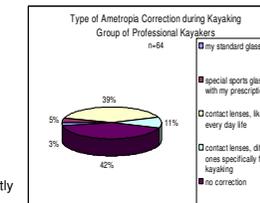


Figure 8: Ametropia Correction, prof. group

Interfering environmental factors during sport

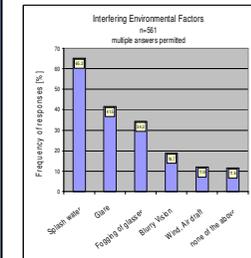


Figure 9: Interfering environmental factors during kayaking

Disturbing Factors during Kayaking % of athletes mentioning disturbing factors (multiple answers permitted)	Essential Appearance (%) (n=561)	Sun Glasses (n=455)	
		YES (n=136)	NO (n=405)
Splash Water	65%	69.9%	63.8%
Fogging of Glasses	34%	42.7%	21.2%
Blow	42%	26.7%	45.9%
Wind / Air Draft	12%	13.2%	11.8%
Blurry Vision	19%	17.6%	19.0%
None of the above	12%	8.8%	15.4%

Legend for degree of deviation (%): from-expected appearance
 -10% (red), -5% (orange), +5% (yellow), +10% (green), 0% (white), -10% (purple), -15% (dark purple)

Table 1: Interfering environmental factors regarding sun-protective eyewear

- The most common interfering factor is splash water for all athletes, regardless of correction method (Figure 9).
- When analyzing the sun- and non-sunglass-wearers (Table 1), the effects of splash water, wind, air draft and blurry vision are rated nearly the same by both groups.
- The leading advantage of sun-eyewear is less affection by glare, while fogging of glasses is the main disadvantage. This difference is statistically significant ($p=8.24 \times 10^{-12}$, chi-square-test).

Conclusions

- It was possible to evaluate experience and the utilization of refractive correction in kayak athletes with consideration of specific conditions in water sports via a web-based survey.
- High visual performance is important for the majority of kayak athletes.
- The actual visual performance is rated statistically significant lower over all investigated groups compared to the importance of visual performance.
- Differences regarding the visual correction used in everyday life to the sport situation were found.
- The percentage of non-corrected athletes increases from 7% to 29% from everyday life to the sport situation. The correction drop-outs for the sport situation come primarily from spectacle wearers and less from contact lens wearers in the everyday life situation.
- The non-corrected group is characterized by a higher tolerance for visual degradation and assesses visual performance as statistically less important than other correction groups
- The decision about the correction method comes primarily from the athlete himself and then from the eye care practitioner. No statistical difference is present between the recreational and the professional group.
- Different correction methods (spectacles, contact lenses, no correction) were investigated. Visual performance during sport was rated highest by contact lens wearers (with everyday life type).
- Contact lenses and no correction are the two dominating correction methods in professional kayakers.
- Flat water kayakers prefer mostly spectacles; white water kayakers prefer mostly contact lenses.
- Loss of correction method appears with all types of correction. Splash water is the leading disturbing factor for all correction methods and is assumed to be initial factor for dislocation of contact lenses.
- Sun eyewear is popular for 66.9% of flat water kayakers, while only 7.8% of white water athletes use sunglasses.
- The collected data and findings might be used for improved care and recommendations for kayak athletes by eye care practitioners.