

# RELATIONSHIP BETWEEN PTERYGIUM/PINGUECULA AND SUNLIGHT EXPOSURE AMONG POSTMEN IN CENTRAL TAIWAN

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**Background.** The purpose of this study was to investigate outdoor hazards and their relationship to conjunctival disorders experienced by postmen.

**Methods.** Three hundred and ninety-four employees (248 postmen and 146 officers) working in 11 post offices in central Taiwan were recruited and participated in the 1994 annual labor health examination. Pinguecula and pterygium were diagnosed by an ophthalmologist. Meanwhile, detailed personal and occupational information was obtained using a structured questionnaire. The cumulative occupational sunlight exposure was calculated for each postman by considering the duration of their employment as postmen, the average working hours per day and their spectacle use (sunglasses and eyeglasses). A logistic regression was used to analyze the relationship between cumulative occupational sunlight exposure and pinguecula.

**Results.** Among the postmen, the prevalences of pinguecula and pterygium were 62.9% and 7.3%, respectively. The outdoor nature of postal work was significantly associated with the occurrence of pinguecula as well as pterygium ( $p < 0.05$ ). When the cumulative occupational sunlight exposure increased by one unit (one year x hour/day), the risks of developing pinguecula and pterygium were raised by 2.1% and 0.8%, respectively.

**Conclusions.** The results indicate that conjunctival disorders were associated with the cumulative occupational sunlight exposure of postmen working outdoors. This study reinforces the importance of ocular protection from sunlight.

KEYWORDS: pinguecula, postmen, pterygium, sunlight

Postal work is a labor-intensive occupation, especially regarding the collection, carrying and delivery of mail, which cannot be done by machine. Due to changes in the economic environment in

Taiwan, the handling of manpower resources is becoming more challenging. Hence, it is extremely important to avoid occupational hazards and resultant loss of manpower while maintaining the regular operation of postal work. Postmen spend much of their working hours in the outdoor environment, with a consequently high exposure to sunlight. Studies in Maryland, USA showed that watermen have a high prevalence of pinguecula and pterygium, which is related to their exposure to sunlight.<sup>1</sup> Many other

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studies also reveal that there is a high possibility for outdoor workers to suffer from conjunctival disorders such as pinguecula and pterygium.<sup>2,3</sup> These studies suggest that exposure to sunlight may be associated with an increased risk of conjunctival disorders, which may cause visual defects.<sup>4</sup> In warm and subtropical areas such as Taiwan, outdoor workers are believed to have a relatively higher risk of exposure to ultraviolet radiation (UVR). To the best of our knowledge, there is still no study concerning related occupational diseases among postmen in Taiwan.

The purpose of this study is to investigate the prevalence of pinguecula and pterygium in postmen in Central Taiwan, and to examine the relationship between sunlight exposure and conjunctival disorders.

### Subjects

The postal employees of 11 post offices in central Taiwan, located between latitude 23°30'N and 24°30'N, participated in annual labor health examinations from September 27 to December 8, 1994. Postal employees were classified according to their duties into two groups, indoor (postal officers) and outdoor (postmen) workers. There were 524 postal employees (332 postmen and 192 officers) who were eligible for this study. Altogether, 394 employees (75.2%) were examined and interviewed, including 248 postmen and 146 postal officers.

### Questionnaire

A structured, pretested questionnaire was administered by a trained interviewer without knowledge of the result of each subject's ophthalmologic examination. Detailed personal and occupational information was obtained, including birth date, gender, employment history, current position, division of duties, employment length, average daily outdoor working hours and whether or not spectacles (sunglasses and eyeglasses) were worn.

### Ophthalmologic examination

Each subject had an ocular examination by an ophthalmologist. The ophthalmologist was unaware of each subject's occupational and sunlight exposure history, in accordance with the blind design of this study.

### Ocular exposure to sunlight

In this study, indoor sunlight exposure was minimal and was, thus, ignored. The accumulative sunlight exposure included sunlight exposure while wearing spectacles and sunlight exposure without wearing spectacles. Exposure was calculated by the following formula. 1) Length of outdoor employment without wearing spectacles x average daily outdoor work hours; 2) Length of outdoor employment while wearing spectacles x average daily outdoor work hours without

**Table 1.** Personal and occupational information of the 394 postal employees

	Postmen (n = 248)	Postal officers (n = 146)	p value
Age, years			0.019
Mean ± SD	39.7 ± 8.5	38.1 ± 5.5	
Range	18-16	27-58	
Gender (n)			< 0.001
Male	237	15	
Female	11	131	
Employment length (years)			0.108
Mean ± SD	14.4 ± 7.5	15.5 ± 5.4	
Range	2-38	1-30	
Outdoor employment length (years)			
Mean ± SD	12.4 ± 7.5		
Range	1-37		
Outdoor work hours (hours/day)			
Mean ± SD	5.8 ± 1.3		
Range	2-9		

SD = standard deviation.

**Table 2.** Occurrence of pinguecula/pterygium in postmen and postal officers

	Postmen (n = 248)	Postal officers (n = 146)	p value
Pinguecula			< 0.001
Present	156	43	
Absent	92	103	
Pterygium			< 0.001
Present	18	0	
Absent	230	146	

wearing spectacles  $\times 1$  + average outdoor work hours while wearing spectacles  $\times R$ . The unit of measure is year  $\times$  hour/day. R is the ratio of sunlight exposure while wearing spectacles to sunlight exposure without wearing spectacles. The value of R, 0.21, obtained by Rosenthal et al was used for our calculations.<sup>5,6</sup>

Postal authorities strictly request postmen to wear a work hat. However, it was difficult to calculate the shielding effect of the hat. An exposure model was set to exclude the shielding effect of wearing a hat. The use of this exposure model is illustrated by the following example. Assume a postman worked outdoors for 10 years, and wore spectacles in the last six years. This postman worked an average of seven hours per working day outdoors, in which five hours were while wearing spectacles. The consequent cumulative sunlight exposure =  $(4 \times 7) + \{6 \times [(2 \times 1) + (5 \times 0.21)]\} = 28 + 18.3 = 46.3$  (year  $\times$  hour/day).

### Statistical analysis

Data were analyzed with the use of the SAS statistical software package (SAS Institute Inc, version 6.0, Cary, NC, USA). The separated *t*-test was applied to compare means of age and employment length in postmen and postal officers when the group variances were

unequal.<sup>7</sup> The chi-squared test was used to examine the association between working environments, or gender and prevalence of pterygium and pinguecula. A logistic regression model was used to analyze the independent contribution of accumulated sunlight exposure during outdoor work to the risk of each disease. The controlling variable was age. Odds ratios and 95% confidence intervals were also calculated. A *p* value of less than 0.05 was considered to be statistically significant.

## RESULTS

A total of 394 postal employees, 248 postmen and 146 postal officers, were examined. Their average ages were 39.7 and 38.1 years, respectively. The mean age of postmen was significantly older than that of the postal officers. There was a significant difference in gender proportions of postmen and postal officers. The average length of employment and outdoor working hours for postmen were 12.4 years and 5.8 hours per day, respectively (Table 1).

Overall, 156 postmen (156/248, 62.9%) and 43 postal officers (43/146, 29.5%) had pinguecula, and 18 postmen (18/248, 7.3%) and none of the officers had pterygium. There was a significant association between pinguecula and the work environment. There was also a similar association for pterygium (Table 2). The prevalences of pinguecula and pterygium progressively increased with the age of postal employees (Figure).

One hundred and sixty-one male and 38 female employees were diagnosed with pinguecula. However, 18 male and none of the female employees were diagnosed with pterygium. Since very few of the postmen were female and few males were postal officers in this

**Table 3.** Odds ratio for pinguecula/pterygium in 394 postal employees according to cumulative occupational sunlight exposure, adjusted for age

	Pinguecula			Pterygium		
	OR	95% CI	p value	OR	95% CI	p value
Cumulative occupational sunlight exposure (year $\times$ hour/day)	1.021	1.01-1.03	< 0.001	1.008	1.00-1.02	0.08

OR = odds ratio; CI = confidence interval.

**Table 4.** Occurrence and odds ratio (OR) of pinguecula and pterygium in 248 postmen according to use of spectacles, adjusted for age

	Pinguecula			Pterygium		
	Present	Absent	OR (95% CI)	Present	Absent	OR (95% CI)
Spectacles Worn	56	54	1.0	6	104	1.0
Not worn	100	38	2.26 (1.30-3.92)	12	126	1.16 (0.39-3.41)

CI = confidence interval.

study, no further analyses were done on the influence of gender on pinguecula and pterygium in the different work environments.

Logistic regression analysis revealed a significant association between pinguecula and cumulative occupational sunlight exposure (Table 3). When the cumulative occupational sunlight exposure increased by 1 unit (year x hour/day), the risks of developing pinguecula and pterygium were raised 2.1% and 0.8%, respectively. After an adjustment for age, there was a 2.26-fold risk of developing pinguecula in postmen who did not wear spectacles compared with those who wore spectacles (Table 4) ( $p < 0.05$ ). However, there was no association between pterygium and wearing spectacles in this study.

## DISCUSSION

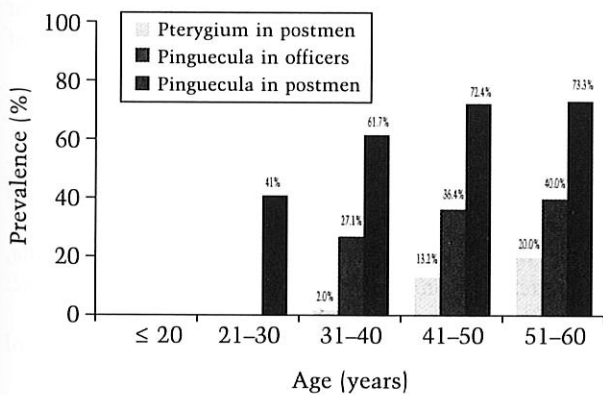
The existence of pinguecula and pterygium in postmen was related to their work environments and the

prevalence was higher than that in postal officers. In this study, the prevalences of pinguecula and pterygium among postmen were lower than that in watermen.<sup>1</sup> It is probable that reflection of sunlight off the water in the work environment of watermen plays a larger role than reflected sunlight in the work environment of postmen.

Because there were very few female postmen and male postal officers in this study, the influence of gender on pinguecula and pterygium could not be properly evaluated. In our study, the higher prevalence of male postmen with pinguecula and pterygium might be due to the job distribution of male workers. Furthermore, no relationship between gender and these ocular diseases has been previously reported in the literature.<sup>8,9</sup>

Some previous studies suggest that the UVR from sunlight may be the major cause of pinguecula and pterygium.<sup>10,11</sup> Other studies suggest that factors such as dust, sand and chronic inflammation of the conjunctival area influence the formation of pinguecula and pterygium.<sup>12</sup> While there has been no agreement on the factors causing these conjunctival disorders, it is generally accepted that pinguecula and pterygium are related to UVR.

Previous studies used surrogate variables such as latitude, daily exposure hours, employment length and average annual sunlight exposure to estimate the total sunlight exposure of an employee.<sup>10,11</sup> For our study, we developed a model to quantify occupational sunlight exposure. After controlling the variable of age, we found that there were different relationships between cumulative sunlight exposure and pinguecula and pterygium. The risk of these diseases was reduced with less cumulative occupational exposure of sunlight. Because the effect of wearing a work hat was excluded and the ratio of ultraviolet-blocking effect (with/with-



**Figure.** Age-specific prevalence of pterygium and pinguecula in 394 postal employees.

out wearing spectacles) was used as the minimal value, the cumulative sunlight exposure of our model could be overestimated.

Both pinguecula and pterygium are related to long-term sunlight exposure. However, relationships between pinguecula and pterygium, and sunlight exposure are still controversial. It is necessary to conduct further research to identify the exact relationship. Because pinguecula and the early stages of pterygium have pathohistologic similarities, they are often considered to be related to each other. Austin et al and Arenas et al suggested that they were two stages of the same condition.<sup>12-14</sup> Pinguecula was thought to be the precursor of pterygium. Although pinguecula does not cause discomfort, it actually causes histopathologic change in the conjunctiva and can be regarded as an index of hazard to sunlight exposure. Wearing or not wearing spectacles had a significant association with pinguecula, but not with pterygium. This result was different from the case-control study by Mackenzie et al in Australia.<sup>3</sup> Their results showed that the risk of developing pterygium could be decreased five-fold by UV protective sunglasses. Because these postmen with pterygium and/or pinguecula did not know the exact time in which pterygium and/or pinguecula developed, the risks of developing pinguecula and pterygium while wearing spectacles might be underestimated.

It has been suggested that persons wearing spectacles made of glass or plastic appear to be relatively protected from the development of these conjunctival diseases.<sup>5,6</sup> Plastic lens and coated glasses have a greater than 98% blocking effect on UVR. Glass is slightly less effective in blocking UVR, but still reduces transmission to less than 15%. In our study, the shielding effect of wearing a hat and UVR was not evaluated. However, it has been shown that ocular exposure to UVR can be reduced by wearing a hat with a brim.<sup>6</sup> Because long-term sunlight exposure has a significant effect on developing pinguecula and pterygium, it seems quite important to wear appropriate devices for protection from sunlight. We recommend the following:

1) Postmen should avoid working outdoors during noontime as much as possible.<sup>15</sup> The amount of UVR varies markedly during the day. It is highest in the summer between 10:00 hours and 14:00 hours. Flexible adjustment of work time reduces the hazard to sunlight exposure.

- 2) To minimize ocular exposure to sunlight, postmen should be advised to wear close-fitting spectacles when working outdoors.
- 3) Postmen should have regular ophthalmologic examinations. Once pterygium is diagnosed, postmen should reduce outdoor work hours or apply for indoor duties.

We found that pinguecula and pterygium occurred more often in postmen than among postal officers. This is an important issue in the reduction of the incidence of these ocular diseases in postmen. Workers must be protected from sunlight, so that limited manpower resources can be maintained.

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