

## Refractive Changes among Nepalese Youths Working in South Korea Under Employment Permit System

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### Abstract

**Aim:** To determine the change in refractive status in Nepalese youths previously working in South Korea as an employee under the South Korean Employment Permit System and come back Nepal as committed candidate for re-health checkup after completing their first phase of 5 years working contract.

**Methods:** A hospital based cross sectional study among Nepalese youths aged 23 - 45 years, was conducted at the Civil Service Hospital, Kathmandu, Nepal from 15th of November, 2017 to 15th of January, 2018. 554 consecutive subjects re-visited the Ophthalmology Out Patient Department in this study period as per directed by the Department of Foreign Employment (EPS-Korea branch) for ocular examination. Most of them were previously emmetropic (n = 532; 96.03%) and some of them wore correcting glasses (n = 22; 3.97%) which they started wearing 5 years back. All the subjects were recruited for refraction and we investigated the change in refractive status.

**Results:** The mean age of the total 554 study subjects was  $30.95 \pm 4.49$  years (23 - 45), among them 529 were male and only 25 were female. We also found 20 each of them having color vision defect and higher cupping. The prevalence of myopia increased significantly from 3.97% to 26.35% ( $p < 0.001$ ). The mean change in values for the spherical and cylindrical powers of right eyes between previous refractive error (before 5 years) and recent refractive error (at the time of examination) are: 1.04D ( $p = 0.001$ ) and 2.229D ( $p < 0.001$ ) respectively; similarly those for left eyes are: 1.14D ( $p < 0.001$ ) and 1.958D ( $p < 0.001$ ).

**Conclusions:** There was significant increase in myopic refractive error (both spherical and cylindrical) in the subjects who came for ocular examination after finishing their first 5 years of assignment as an employee under The South Korean Employment Permit System.

**Keywords:** The South Korean Employment Permit System, Adult-onset Myopia, Committed Candidate, Spherical Power, Cylindrical Power

### Introduction

For over one hundred years there has been discussion on the etiology of myopia, a disorder that today affects a substantial part of the general population. Cross-sectional studies presenting the prevalence of refractive errors in different demographic strata throughout the world have revealed a considerable variation in the prevalence of myopia in different populations. In the Nordic countries, between 25% and 33% of the general adult population are reported to be myopic [1-4] with at least 25 - 30% of these being adult-onset myopia, i.e. with an onset at the age of 18 years or older [5,6].

Theories about a biological versus an environmental cause have been alternately dominant. Investigating possible environmental factors, several studies have indicated that there is a statistical correlation between myopia and the amount of near-work [7,8]. Performing longitudinal studies, a refractive change in the direction towards myopia among adults with a high amount of close work was demonstrated in some studies, but these are relatively scarce [9-13].

The attention was particularly directed towards adults who had gone to foreign land and working for more than 11 hours daily and making themselves busy doing intensive near vision activities like playing with their cell phones and other visual display units and hanging on internet, closed between the four walls during leisure hours. Meanwhile, examining previous colleagues we found significant num-

ber of employee returning back with the myopic shift in the refractive status. Therefore, we had a clue for the need of such study. The aim of this study was to determine the change in refractive status in Nepalese youths previously working in South Korea as an employee under the South Korean Employment Permit System and come back Nepal as committed candidate for re-health checkup after completing their first phase of 5 years working contract. However, the current study does not correlate the change in the refractive error with the type of work they had to do during the 5 years stay at South Korea.

## Materials and Methods

### Research design and sample size

A hospital based cross sectional study among Nepalese youths aged 23 - 45 years, was conducted at the Civil Service Hospital, Kathmandu, Nepal from 15<sup>th</sup> of November, 2017 to 15<sup>th</sup> of January, 2018. 557 consecutive subjects re-visited the ophthalmology OPD and refraction unit during this study period as directed by the Department of Foreign Employment (EPS- Korea branch) for ocular examination. Previously (5 years back), whom the hospital itself provided medical certificate that permitted them to work in South Korea mainly in industries and agricultural sectors.

The investigation adhered to the tenets of the Declaration of Helsinki. The study protocol was approved by the institutional ethics of Civil Service Hospital, Nepal. An informed consent was obtained from all the participants after explaining the objective of the study.

### Assessment

Unaided, best spectacle corrected visual acuity (BSCVA) and color vision assessment was taken using digital acuity chart (Auro chart) at six meters distance. Detailed anterior segment evaluation with the slit lamp (Shin Nippon) was carried out. For uniformity in methodology, irrespective of the ages, all patients underwent cycloplegic refraction under 1% cyclopentolate and subjective refraction was performed to attain best corrected visual acuity. Evaluation of the fundus, optic nerve head and the posterior pole was performed meticulously with direct ophthalmoscope (Heine Beta 200) and the slit lamp and +90D aspheric lens (Volk: California, USA).

### Sample selection

Total of 557 subjects re-visited the eye OPD and all of them were examined. The eyes that were considered normal based on the screening and definitive examination were included in the analysis. Out of 557 subjects, 554 were recruited for data analysis. Among those 3 subjects who were disallowed, one had left eye total retinal detachment, second subject was bilateral surgical aphakia and third subject was excessive cylinder power on both eyes and on retinoscopy there was presence of scissoring reflexes.

### Data analysis

The total of 554 subjects were eligible and considered for further analysis. Both the eyes were separately analyzed to determine the change in refractive error between previous and recent dioptric power of the eyes. The spherical and cylindrical powers are taken as separate entity. We did not analyzed for the spherical equivalent unlike other previous studies. The mean values for the change in spherical and cylindrical powers in both right and left eyes before 5 years (previous) and at the time of examination (recent) was determined using paired t- test. The  $p < 0.05$  were considered significant at 95% confidence interval (SPSS 21.0 for Windows).

## Results

The mean age of the total 554 study subjects was  $30.95 \pm 4.49$  years (23 - 45). Among them 529 were male and only 25 were female. 20 each of these subjects had color vision defect and higher cupping. The prevalence of myopia increased significantly from 3.97%;  $n = 22$  to 26.35%;  $n = 146$  ( $p < 0.001$ ). Out of 146 who developed change in refractive status (myopic shift), 26.03%;  $n = 38$  had to wear spherical lens, 58.09%;  $n = 86$  had to wear cylindrical glass and 15.07%;  $n = 22$  had to wear sphero-cylindrical lens.

Table 1 shows the mean  $\pm$  standard deviation values of 146 subjects' previous and recent refractive error in each eyes separately. The spherical and cylindrical powers are taken as separate entity.

Table 2 shows the mean difference in values between previous and recent refractive power for each eyes separately. Here too the spherical and the cylindrical power are separately analyzed. The mean difference in dioptric values for spherical power between recent and previous refractive error in right and left eyes are 1.04D ( $p = 0.001$ ) and 1.14D ( $p < 0.001$ ) respectively. The mean difference in dioptric values for cylindrical power between recent and previous refractive error in right and left eyes are 2.229D ( $p < 0.001$ ) and 1.958D ( $p < 0.001$ ) respectively.

Parameters	Mean(D) ± SD	Age Group (years) (23 - 30)	Age Group (years) (30 - 45)
Previous Spherical Power Right Eye (PSPRE)	-0.450 ± 0.337	-0.410 ± 0.299	-0.420 ± 0.321
Recent Spherical Power Right Eye (RSPRE)	-1.490 ± 0.430	-1.510 ± 0.420	-1.600 ± 0.390
Previous Spherical Power Left Eye (PSPLE)	-0.450 ± 0.343	-0.490 ± 0.340	-0.480 ± 0.313
Recent Spherical Power Left Eye (RSPLE)	-1.590 ± 0.426	-1.470 ± 0.418	-1.480 ± 0.436
Previous Cylindrical Power Right Eye (PCPRE)	-0.225 ± 0.115	-0.223 ± 0.120	-0.227 ± 0.114
Recent Cylindrical Power Right Eye (RCPRE)	-2.459 ± 0.282	-2.462 ± 0.284	-2.456 ± 0.279
Previous Cylindrical Power Left Eye (PCPLE)	-0.220 ± 0.111	-0.200 ± 0.110	-0.240 ± 0.121
Recent Cylindrical Power Left Eye (RCPLE)	-2.178 ± 0.238	-2.181 ± 0.235	-2.175 ± 0.242

**Table 1:** The mean ± SD values for the previous and recent refractive error of right and left eyes in 146 subjects (total number of subjects with refractive error in last follow up) with changes in refractive error.

Data are shown for the right and left eyes as previous and recent refractive error and spherical and cylindrical power separately (n = 146).

Parameters	Mean Difference in Diopter	P - value
Previous Spherical Power Right Eye - Recent Spherical Power Right Eye	1.040*	p = 0.001
Previous Spherical Power Left Eye - Recent Spherical Power Left Eye	1.140*	p < 0.001
Previous Cylindrical Power Right Eye - Recent Power Cylindrical Right Eye	2.234*	p < 0.001
Previous Cylindrical Power Left Eye - Recent Power Cylindrical Left Eye	1.958*	p < 0.001

**Table 2:** The mean difference in dioptric values between previous and recent refractive error in 146 study subjects with changes in refractive error.

Data are shown for the right and left eyes as previous and recent refractive error and spherical and cylindrical power separately (n = 146).

Paired sample t- test was used for data analysis. Data are Pearson’s correlation coefficients (P). \* Test significant at p < 0.05.

### Discussion

South Korean has signed in memorandum of understanding with Nepal regarding Employment Permit System (EPS). South Korea started to employ Nepalese youth (male and female) along with other employee from different developing countries like Nepal in different sectors as foreign labors. Nowadays, they are mainly enrolled in industries and agricultural sectors. These employee must be physically and mentally fit to get permit for working in South Korea. In the ocular examination visual acuity in each eye with 6/6 after correction or unaided and normal color vision are considered eligible. The first phase of assignment completes after these employee work there for 5 years. During this period, they are mostly isolated and have monotonous life activities. They are compelled to spend their leisure time playing with cell phone and other visual display units. This prolonged near activities could be the major environmental factor to development of myopic refractive error (both spherical and cylindrical). However, the present study does not correlate the myopic shift in refractive error with the type of occupation and working condition of the participants in South Korea. This has been the major limitation of the present study. Similarly, the degree of myopia increment in older and younger adults was similar, suggesting that late adult onset myopia can be the cause of refractive error change in older adults.

The results obtained in the present study are in agreement with other studies demonstrating that the prevalence of myopia increases in adults exposed to prolong near activities [14-18]. In the present study, an overall increase in the prevalence of myopia of 22.38% during this 5 years stay in South Korea in Nepalese youths are revealed. This is considerably higher than the increase in myopia by 5.38% among the Norwegian engineering students [18] and by 8.38% among medical students at Taiwan [14] who are supposed to exposed to higher educational demand and prolong near activities. Law students in California followed for 6 months had a 38% myopic shift [17], which is relatively high value compared to the present study.

Naturally, it would be of interest to know the kind and degree of refractive error change over time in a group of non-academic population, so we attempted to study in Nepalese employee who are mostly engaged in using display units in their leisure time. There are some other studies of refractive changes to demonstrate the same tendency of myopic shift as in the present study among other professions (academic) with sight-demanding conditions for the eyes. A longitudinal study among clinical microscopists with mean age of 30 years revealed that 45% developed myopia during two year period [11]. Furthermore, a case-control study among a small group of textile workers in Norway exposed a high prevalence of myopia and adult-onset myopia among those having short working distance of 30 cm [20-23]. These results support the theory that near work such as reading and close work activities is a risk factor for development of myopia. However, the present study does not correlate the time (hours/day) these participants spend playing with display units or the total time they do near work at their working place. Other major limitation can be the absence of studying the effect of level of illumination of the display units and the increase in myopia.

The most striking results we are amazed of is the high prevalence of cylindrical myopic error among Nepalese subjects. Among 146 subjects who had change in refractive status, 58.09% (n = 86) were corrected with the cylindrical lenses. This statistic suggests that there is some kind of relation between prolong visual display unit use and development of cylindrical power. An important limitation of the study is not having topographic or keratometric data, so we could not differentiate the refractive error being refractive or axial type. Previous studies have taken the spherical equivalent power as the unit for estimation of refractive error change. But, in the present study, we have analyzed the spherical and cylindrical power separately because we realized most of them had developed only cylindrical power. We expect other following researchers to take this into account and see for the relation between cylindrical power development and prolong near activities in visual display units.

## Conclusions

There was significant increase in myopic refractive error (both spherical and cylindrical) in the subjects who came for ocular examination after finishing their first 5 years of assignment as an employee under The South Korean Employment Permit System previously most of whom were emmetropic.

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