

A Comparative Assessment of Near Point of Convergence between Goldsmiths and Normal Population

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Abstract

The process of jewelry making involves minute visual tasks at closer working distance for goldsmiths, which demands high visual ability that eventually might result with receded near point of convergence (NPC). Hence the aim of our study is to compare the near point of convergence between goldsmiths and normal population. One group of 72 male experienced goldsmiths and other group of 72 male normal populations were evaluated. Binocularly the near point of convergence was tested with sharpened tip of pencil. The patient age ranges between 30 to 60 years with best corrected visual acuity of 6/6, N6 monocularly without any ocular pathology were included in both the groups. The other near occupational work was excluded for normal population. The p-value for subjective comparison of NPC is 0.008 and for the objective comparison of NPC is 0.0005 which showed a highly statistical significant changes between goldsmiths and normal population for both subjective and objective comparison. Hence this test can be used as a clue to suspect whether the goldsmiths having convergence insufficiency and to decide on referring the patient for further binocular vision assessment and treatment accordingly.

Keywords: Goldsmiths, near point of convergence, sharpened pencil tip.

Introduction

Occupational vision is a branch of optometry and the intention of the occupational vision assessment which spots goldsmith ocular health, management, protection, vision training, and effective level of productivity to improve their performance.^[17] “Clearly, the way we use our eyes can determine how well we learn, work and perform” (Anshel, 2006, p.20).^[2] The occurrence of many diseases is influenced by occupation.^[12]

A goldsmith is a person who makes jewels using gold or other precious metals such as silver, platinum and stones etc. Goldsmith usually specialize in cutting, filing, hammering, turning, spinning, bending, casting gold or other metals, engraving jewelry, repair or remodel jewelry which requires higher visual demands^[7,18]. Visual information nourish the goldsmiths what to do, where to do, how to do. Visual skills for goldsmiths include visual abilities, depth and color perception, eye motility, eye-hand coordination, visualization and contrast sensitivity for edge detection.^[11]

The jewelry manufacturing industry can be divided into two productions such as craftwork and mass production. This article is based on the craftwork that is individual articles that are hand-made by skilled craftsmen. In jeweler's workshops where the environment may involve some noise, dust and other impurities, hence goldsmiths needs to acquiring knowledge or awareness of the occupational health and safety act, handling designated substances, wearing, adjusting and maintaining protective equipment.^[11, 5]

Convergence insufficiency (CI) is a non-strabismic binocular visual anomalies characterized by the eyes which is unable to converge correctly for a considerable period of time when a near task is performed.^[15] The incidence of convergence insufficiency in the general population is 0.1% to 0.2% while exodeviation are present only 1%^[11]. Convergence insufficiency is associated with a group of symptoms includes headache, blurred vision, visual fatigue, eye strain and double vision^[3, 10]. These symptoms occurs while doing near work such as reading, computer viewing, tailoring, jewelry making etc. Salve et al concluded that goldsmiths may experience subjective visual disturbance^[13] especially convergence

anomalies. Monroe J. Hirsch suggested that eye discomfort or eye fatigue accompanied when the individual is engaged for prolonged near work and concludes that the orthoptic training is useful to disappear ocular discomfort, fatigue and other subjective symptoms.^[6]

The NPC is one of the diagnostic tests often performed to help to determine the convergence insufficiency^{[8][10]}. The normal range of NPC is TTN to 10cm when it exceeds above 10cm then it should said to be convergence insufficiency^[3].

As a result, the vision standard could be used as minimum visual requirements for the entry level goldsmiths concluded by R. Monica and et al and their near point of convergence are receded when compare to normal population. Therefore near point of convergence between goldsmiths and normal population was compared.

Methods and materials

The study was approved by the ethics committee. Seventy two experienced male goldsmiths were recruited based on connivance sampling and seventy two male normal populations were recruited based on random sampling for the study. Patients visited for ophthalmology clinic, Sri Ramachandra University and Research Institute in porur for the first time without any ocular pathology. Participation was voluntary and proper permissions were taken. Demographic, medical, and visual information were received on day of the examination.

The near point of convergence is performed using the sharpened tip of pencil binocularly. All measurements were performed under same conditions on two groups for both subjective and objective procedure. All the tests were performed by the single examiner. It describes the holding ability of eye to converge in that the patient can maintain and hold the fusion, so that the patient can perceive as single target. The examiner moves a target gradually towards the patient and the target seems to be a sharpened tip of pencil. The procedure was performed in front of patient face and the patient will trace towards the target. The final point is measured and noted when the patient reports by seeing sustain double image then it is taken subjective observation and when the examiner notices one of the patient eye is deviating outwards then it is taken as objective observation. Using the pencil tip target measurements were taken for break response and recorded in centimeters. A measurement has been repeated thrice for consistency and average value has been taken.

The subject having 6/6, N6 monocular and binocular distance and near acuity respectively with habitual refractive correction with the age group between 30 to 60 years were satisfying inclusion criteria for both groups. The other near work related subjects such as tailor, computer user etc., were excluded for normal population.

The result of this study was assessed using IBM.SPSS statistics software 23.0 Version. To describe about the data descriptive statistics frequency analysis, percentage analysis were used for categorical variables and the mean & S.D were used for continuous variables. Hence to find the significant difference between the categorical variables in independent groups the Pearson's Chi-Square test was used. In the above statistical tools the probability value .05 is considered as significant level.

Results

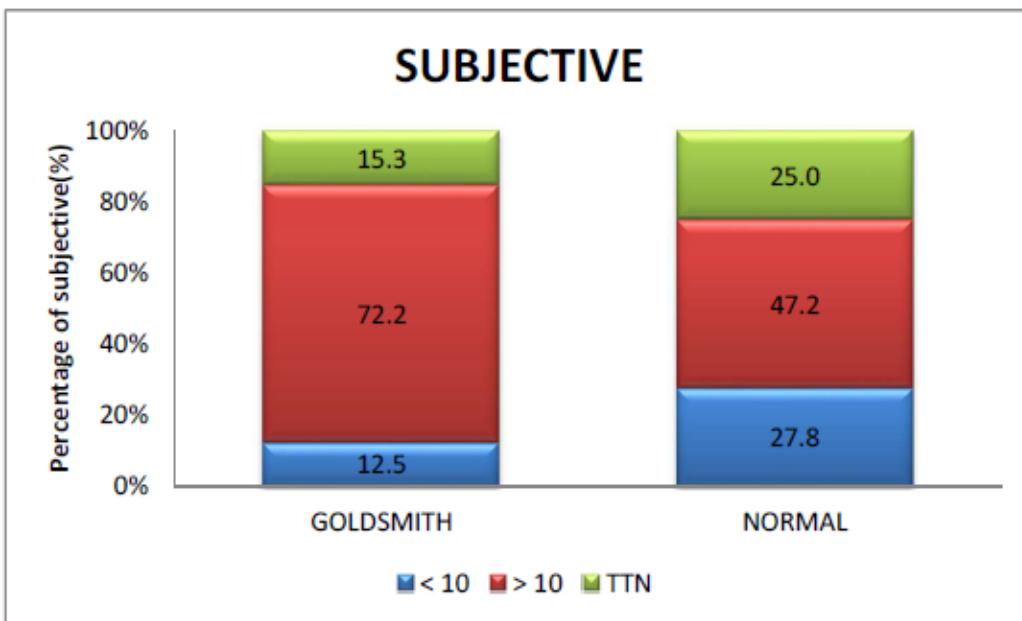
One hundred and forty four males were included in this study. In this population seventy-two were experienced goldsmiths and seventy-two were normal population.

The subjective of goldsmith 9(12.5%) patients are <10 and 52(72.2%) patients are >10 and 11(15.3%) patients are TTN and for normal population 20(27.8%) patients are <10 and 34(47.2%) patients are >10 and 18(25.0%) patients are TTN. [Table 1, Graph1].

Table1. Subjective comparison between goldsmith and normal population

Subjective comparison						
		GOLDSMITH	NORMAL	Total	χ^2 Value	P-Value
< 10	Count	9	20	29	9.63	0.008 **
	%	12.5%	27.8%	20.1%		
> 10	Count	52	34	86		
	%	72.2%	47.2%	59.7%		
TTN	Count	11	18	29		
	%	15.3%	25.0%	20.1%		
Total	Count	72	72	144		
	%	100.0%	100.0%	100.0%		

** Highly statistical significance at P ≤ 0.01 level



Graph 1. (Subjective comparison between goldsmith and normal population)

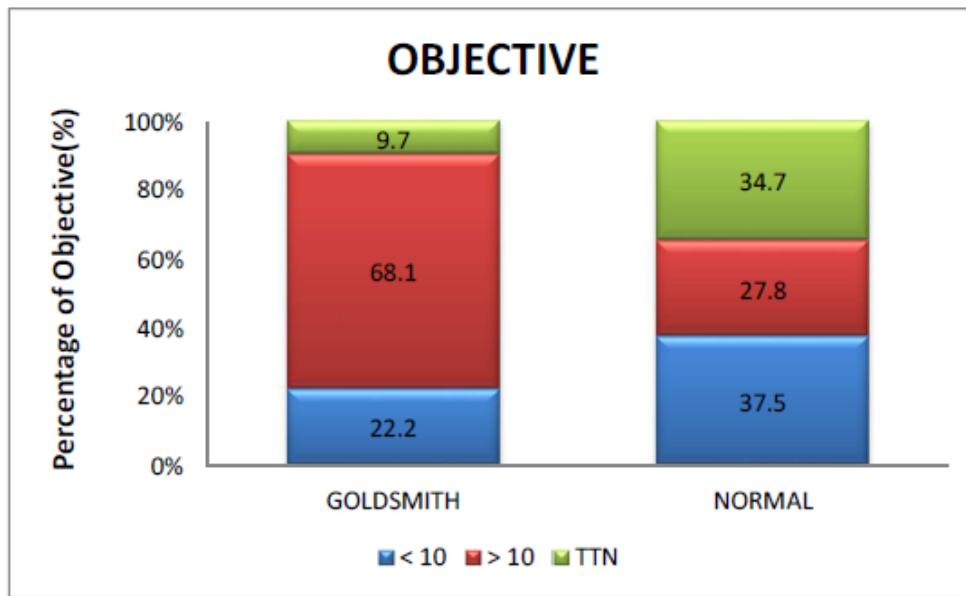
The objective for goldsmith 16(22.2%) patients are <10 and 49(68.1%) patients are >10 and 7(9.7%) patients are TTN and for normal 27(37.5%) patients are <10 and 20(27.8%) patients are >10 and 25(34.7%) patients are TTN. [Table 2, Graph 2].

Table2. Objective comparison between goldsmith and normal population

Objective comparison						
		GOLDSMITH	NORMAL	Total	χ^2 Value	P-Value
< 10	Count	16	27	43	25.127	0.0005 **
	%	22.2%	37.5%	29.9%		
> 10	Count	49	20	69		
	%	68.1%	27.8%	47.9%		
TTN	Count	7	25	32		
	%	9.7%	34.7%	22.2%		

Total	Count	72	72	144		
	%	100.0%	100.0%	100.0%		

** Highly statistical significance at $P \leq 0.01$ level



Graph 2. (Objective comparison between goldsmith and normal population)

The p-value for subjective comparison is 0.008 and for the objective comparison is 0.0005 and the $p \leq 0.01$ level so there was a highly statistical significant change between goldsmiths and the normal population for both subjective and objective comparison. [Table 1, Table 2].

Discussion

As the results shows, there is a significant difference of near point of convergence between goldsmiths and normal population. Jewelry makers, watch repairers, and electronic manufacturers are classified as engaged in occupations having similar demands. U R Salve concluded that similar visual demands of the task like tired eye, convergence and accommodation problem carried out for both jewellery manufacturing and computer related work.^[13] Similarly Untimanon et al concluded that electronic and goldsmiths have same visual problems.^[18] In the study concluded by Monica R, Krishnakumar R, Santhanam P. P. has shown that the minimum distance visual acuity required for efficient working as 6/12 and expected near visual acuity for habitual working distance (23cm) to be N4, convergence at closer distance in certain areas of work but in this study have taken subjects has expected distance visual acuity as 6/6 and for near visual acuity N6 and they also shown that receded near point of convergence for goldsmiths.^[11] Salve UR also shows that the goldsmiths have convergence problem.^[13] The elements of working at a near task which make it visually demanding include frequent saccadic eye movements (ocular motility) and continuous eye focusing (accommodation) and alignment (vergence) demands.

In the stud Salve UR have concluded that Convergence occurs when the eyes turn "inward and downward" towards the nose when one views close objects^{[13][10]}. These need shrinkage of extra-ocular muscles in which the muscles involves are medial rectus and superior oblique of the eye^[4]. These two muscles lead to eyestrain. The work of the jewelry manufacturing is precise^[13]. The person who involved in goldsmith work like gold, stone and other minute work he have to focuses the object which is tiny in size and the patient will feel discomfort. These lead to higher discomfort in visual and mental attention^[13]. The goldsmith who involved in jewelry making has to maintain their eyes in adduction and downward position^[10]. Due to their long time of exposure and checking the quality of the gems, so the muscles of

eyes get fatigue. The above mentioned conditions may be the reason for higher visual discomfort. Headache is the one of "discomfort" symptom faced by goldsmith and it is most common symptom which seen during an eye examination [13]. The headache occurs to jewelry worker due to their improper workplace condition, poor lighting, and improper workstation [11]. The headache may also occur due to anxiety and depression for this they have separate investigation.

Binocular cues to depth are stereopsis and convergence. In this study, the population had receded near point of convergence (NPC greater than 10cm). Out of those, who had receded NPC, 72.2% were subjectively receded NPC and 68.1% were objectively receded NPC i.e. they had exophoria for near [10]. The previous studies have shown significant improvement in symptoms and clinical measures for near point of convergence by giving vision therapy for symptomatic convergence insufficiency [9]. Vision therapy is best therapy for eliminating asthenopia symptoms and convergence anomalies get improved in adult patients [11]. In-office therapy along with home therapy ends in best results than the home therapy alone [9][14].

There was a high statistical change in near point of convergence between goldsmiths and normal population.

Conclusion

There was a highly statistical change in near point of convergence between goldsmiths and normal population for both subjective and objective comparison. This result can be used to detect for goldsmiths with receded near point of convergence and to decide on referring the patient for further binocular vision assessment and therapy given accordingly to their convergence. At the end, goldsmiths should be aware that vision is also a factor which affects goldsmith performance.

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