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EYECHECK® STUDY

A study was commissioned by SAMANCOR to explore the use of equipment referred to as the EyeCheck®. This equipment is certified in the USA, for the identification of fatigue.

The EyeCheck® is a portable hand held device similar in appearance to binoculars. The candidate looks into the equipment, which then measures pupil size and reaction using a focused "diode light source". Pupil reaction and size measurements are then reported as 'green – OK' or 'red – fatigued'.

An important factor here is the difference between 'tiredness' and 'fatigue'. The former does not refer to a state of muscular or mental exertion after 'normal' activities such as standard shift. The tiredness reported and experienced by workers should be regarded as a sense of weariness (not fatigue), which does cause debilitation to such an extent that dangerous or life-threatening behavior could result. Thus a person who claims to feel tired may not be fatigued.

The concept of fatigue refers to a state beyond tiredness associated with normal strenuous activity. If all normal work functions resulted in fatigue then all post activities would, by default, be hazardous. This clearly is not the case.

In fatigue studies it was concluded that judgment and fatigue states, which lead to dangerous behavior, are similar to a BAC of 0.05. To read this print significantly, more than the legal limit (0.02) needs to be consumed. Similarly to read a level of

fatigue (debilitating) the person needs to report a sleep debt of more than 12 hours. Conversely a person who is accustomed to little sleep is able to function at a seemingly effective level over a prolonged period of time. This habitual sleep debt does however build up and will reach a significant point at a given time. The person will experience fatigue, which results in impaired judgment, mobility, poor dexterity and poor coordination throughout – the result is actions leading to accidents. This is particularly evident in routine, non-stimulating or repetitive work environments. This extreme tiredness - fatigue – also contributes to many vehicle accidents.

The responses above are part of the disturbance patterns identified with circadian rhythm disturbances.

In many work environments, consisting of 8 hour shifts, a degree of tiredness should be produced in some workers. In others, an even more elevated level of stimulation results (pilots report this after battle sorties where high adrenaline levels are experienced).

Pupillary responses will indicate that the person **should** still be able to perform a series of tasks **after** working an 8-hour shift. These activities are driving home, commuting, playing sports and social activity, which all relate to tired but functional people. Fatigue on the other hand is extreme enough to make the person dysfunctional – they fall asleep at the wheel of a car, sleep on the train without being able to be roused and are unable to socialize. In many instances this has been observed in 12 – 16 hour shifts, or double shift workers.

RATIONALE OF THE EYECHECK®

The EyeCheck® is based on the rationale that physiological responses, as measured by the pupil sympathetic nervous system, are independent and accurate indicators of the process called fatigue.

Fatigue is measured as tiredness (normal) and indicated as green (able to maintain functions) and red (no longer able to maintain normal functions as the nervous system responses slow down and will impair judgment).

The person has effectively crossed over to the nervous system having 'gone to sleep' whilst still seemingly functional to an extreme case and this could be linked to a comatose state of brain sleep.

Neurologists have used this principle for years. The EyeCheck® has simply expanded on the principle and used computerized reporting.

COMMENTS ON RESEACH DESIGN

The research design carried out at Samancor, as well as the results obtained, raises some concerns.

The design was mandated to assess the EyeCheck® as a potential tool used to identify fatigue as a major factor in safety policies.

The design used, as well as constructed, a double blind study involving alcohol (controlled) and medication (controlled).

Resulting points of concern can be raised in this regard: The workers results indicated that they were not fatigued (not to the point of dysfunctionality) after a normal shift. This would indicate that the majority of testees are adequate for the job description and that the shift schedules are not problematic. The workers can cope with the content and complexity of the work over the 8 hours without creating undue stress. A hypothesis could be stated that 25% of the workers should be 'positive' for fatigue, 50% should have no significant response and 25% should be totally unaffected by either tiredness or fatigue – almost to the point of being stimulated.

Many industrial workers are also accustomed to the use of alcohol and other stimulants/drugs. Levels of alcohol in low dosages (BAC .00 to .04) have been shown to be stimulatory and do not show up on traffic breathalyzers. Many studies have also indicated the false confidence experienced by exceptionally fatigued people after taking some alcohol, only to become fatigued again after the effects of the stimulant have worn off some time later. This could be explanatory for the effects of the low dosage of alcohol.

Therefore the research design did measure an element associated with the workers. Clarification needs to be had concerning 'Was this tiredness or was this fatigue', which by definition is more than tiredness and affectively causal in safety issues. It is postulated that the candidates did not fall into the category of fatigue (and were therefore not identified as such) but into 'tired after work' (and were measured as such).

High accident risk candidates were not identified, as they were not in the group. The expected post – shift tiredness was identified. These candidates are, generally, not high-risk, as alertness is not excessively impaired but still sufficient for them to maintain normal living. Most respondents reported that they were generally fatigued (tired) in the pre and post assessments. Cognitive performance however was measured as average in both assessments phases and was not indicative of fatigue-related alertness loss.

Accidents are process driven. In many instances the process is in place until it reaches a dysfunctional point. EyeCheck® was designed to identify that point where the candidate no longer functions with full alertness but is unable to process information due to the Central Nervous System (CNS) going into shut – down mode. This is associated with extreme sleep debt - fatigue.

The design successfully measured the impact of variables such as tiredness, alcohol and medication.

The candidates were not in a state of pre-fatigue or fatigue (as being extreme tiredness) with sleep deprivation etc. prior to the study. The candidates were not deprived of sleep in one group and allowed to sleep in the other to differentiate and measure the role of fatigue or 'building tiredness'.

Tiredness was measured and candidates were possibly not fatigued, merely feeling tired. **Many testees indicated being generally fatigued – their basic cognitive performance was average.** Studies by various research groups indicate the efficiency and accuracy of pupilometry for fatigue studies. These also form the basis of the studies which lead to AMERICAN FOOD AND DRUG ADMINISTRATION approval of the EyeCheck® for fatigue and drug/alcohol testing in the USA. FDA certification is generally accepted as sufficient for use in legal action cases in the USA, where legislation is carefully monitored.

In conclusion I would agree that the cognitive tests are highly effective in assessing awareness and judgment. These tests should form a part of a battery to validate the quality and level of fatigue if indicated by the EyeCheck® unit. This would remove the learning effect of cognitive tests as well as become a second line of assessment.

EyeCheck®, under most conditions, takes 1 – 3 minutes. Validation, using cognitive tests, could take 30 minutes or more. A simplified version of series 7, mental calculating or Pauli Test; Reaction Test, or Continues Visual Recognition Test, could also be used, as these are sensitive to concentrative failures or neglect.

EyeCheck® as an international standard unit should be reconsidered in the light of the above, and evidence will be forthcoming of its simple but highly effective role in accident prevention by finding really fatigued workers not simply tired ones.