

in Mirror industry to make amalgamated glasses. While making amalgamated glasses they are produced with the row process in many industries or laboratories. This row process causes formation of large amounts of mercury vapours due to oxidation during the process of making amalgams.

In the developing nations like India there are many chances of not taking the precautions during the production of amalgams. It may produce the toxicity up to some extent. Mercury is more often used in Mirror industry in the form of Amalgams at different temperatures. More commonly, mercury vapours are present at the places in mirror industry which are hazardous to the human health.

Previous reports found an association of occupational mercury exposure results in memory loss, severe depression and behavioural changes.² This study is used to determine the toxic and allergic effect of mercury in mirror industry workers.

Primary Objective (Aim):

To access the occupational mercury exposure levels in the mirror industry in the selected area.

Secondary Objectives:

- 1.To measure the urine mercury levels of occupationally mercury exposed mirror industry workers.
- 2.To access the existing exposure factors.
- 3.To explore mercury poisoning related illness symptoms.
- 4.To describe the relationship between urine mercury level and exposure factor.

Review of Literature:

Signs and Symptoms due to ingestion of Ashuddha Parada:³

1. Murcha (Fainting)
2. Shoka
3. Bhrama (Dizziness)
4. Kampa (Tremors)
5. Chardi (Vomitting)
6. Moha
7. Jwara (Fever)
8. Hikka (Hiccoughs)
9. Vepathu(Tremors)
10. Udarashula (Pain in abdomen)
11. Nidra (Somnolence)
12. Alasya
13. Arochaka
14. Lingastambha
15. Atisara (Diarrhea) 16. Kasa (Cough)
17. Shwasa (Asthema)

18. Vijrumbhika
19. Karna, Asya, Medhra, Chakshu, Kukshi, Vrushana, Udara, Murdha Daha
20. Agnimandya

Parada Bashpaja Vikara Lakshana (Signs and symptoms due to inhalation of Mercury Fumes):⁴

1. Kampa
2. Vadana Kampa
3. Hastapada Kampa
4. IndriyaVikara
5. Mansapeshi Daurbalya
6. Amashaya and Antra Shotha and Shula
7. Melina, Vomitting
8. Murcha
9. Mrutyu

Rasajeerna Chikitsa: (Treatment of Rasajeerna):⁵

1. Karavellaka Swarasa pana with Gomutra, Saindhava and Sarjika kshara.
2. Kadalikanda Rasa, Rajkoshataki Rasa and Karavellaka rasa pana with Gomutra, Saindhava and Sauvarchala lavana.
3. Rasajeerna is very difficult to treat. Many times, it causes death of the person.

Mercury Poisoning in Mirror industry:⁶

Improper handling of historic mercury amalgam mirrors presents a potential risk for elemental mercury exposure. The tin-mercury amalgam from which these mirrors were fabricated is inherently unstable and releases mercury liquid and vapor as it deteriorates. As a result, the mirrors and frames, as well as storage, work, and exhibition spaces can easily become contaminated, placing anyone who interacts with these objects at risk for mercury exposure.

Mercury emissions result from several processes: oxidation of the amalgam, evaporation of the liquid phase, and migration of liquid mercury to the bottom edge of the mirror due to gravity.

Mercury exposure from amalgam mirrors can be mitigated by identifying mirrors containing mercury; responsible exhibition, storage, and handling; following safety protocols when cleaning up mercury spills; and proper recycling and disposal of mercury-contaminated products.

While the degradation of tin-mercury amalgam is inevitable and cannot be reversed, taking these preventative measures and safety precautions allows for the safe exhibition, storage, and handling of these historic objects.

Visual characteristics may help in identification, however, it is safest to assume that mercury is present in any mirror produced prior to the latter half of the 20th century, unless otherwise documented or proven by scientific methods, and therefore should be handled appropriately.

Elemental mercury primarily causes health effects when it is inhaled as a vapor. After exposure to liquid mercury, less than 1% of the total amount is absorbed through ingestion or dermal contact, while 80% of inhaled mercury vapor is absorbed by the respiratory tract and retained in the kidneys and brain (WHO 2000).⁷ Symptoms of high levels of mercury exposure can occur within hours and include respiratory distress, tremors, emotional changes, insomnia, neuromuscular changes, headaches, disturbances in sensations, nausea, vomiting, diarrhoea, and changes in cognitive function. Chronic exposure may result in more severe kidney, respiratory, and cognitive effects. Individuals concerned about their exposure to mercury should consult their physician within three days of exposure for testing and treatment.

Methodology:

1. Type of Study design: Observational Study / Survey Study.
2. Location of Study: Mirror Industry in Maharashtra (Nashik Dist.)
3. Sample Size: 30 Mirror industry workers were selected from Mirror industry in City. 4. Sampling Techniques: i) Observation- as per data collection
ii) Urine Samples was collected for laboratory testing.
5. Method of selection of subjects:
 - a) Inclusion Criteria:
 - i) Occupationally mercury exposure Mirror industry workers working in the same industry for more than 1 year period.
 - ii) Both Gender
 - iii) Mirror industry workers who voluntarily participated in study and sign for consent.
 - b) Exclusion Criteria:
 - i) Mirror industry workers who are known case of medical illness.
 - ii) Mirror industry workers with regular medication.
 - iii) Non-Voluntary Mirror industry workers to participate in the study.

Standard Operating Protocol for collection of Urine sample of the Volunteer:

1. Volunteer should be interviewed thoroughly before collection of the sample.
2. The respective number of survey form was written on the container with permanent black ink marker.
3. The air tight lid of the container was removed and then container was handed over to the volunteer to collect the urine sample.
4. After collecting the urine sample the container was covered with air tight lid.
5. Sample was sent to laboratory for examination in a dark carton box within 24 hours of collection.

Observation and Results:

Table No. 1: Age wise distribution

Sr. No.	Age group (in years)	No. of patients	Percentage
1	18 to 30	1	3.33
2	31 to 40	17	56.66
3	41 to 50	11	36.66
4	>50	1	3.33

Table No. 2: Gender wise distribution

Sr. No.	Gender	No. Volunteers	Percentage
1	Male	5	16.66
2	Female	25	83.33

Table 3: Socioeconomic status wise Distribution

Sr. No.	Socioeconomic status	No. of Patients	Percentage
1	Poor	04	13.33%
2	Middle	19	63.33%
3	Rich	07	23.33%

Table No. 4: Prakruti wise Distribution

Sr. No.	Prakruti Type	No. of Patients	Percentage
1	Vata	04	13.33%
2	Pitta	02	6.66%
3	Kapha	0	0
4	Vata-Pitta	10	33.33%
5	Vata-Kapha	08	26.66%
6	Pitta-Kapha	06	20%
7	Tridosha	0	0

Subjective Criteria:

1. Excessive Salivation with Metallic Taste:

Excessive salivation is a very important symptom of mercury poisoning. Only 4 patients among 30 were having this symptom. To find out the significance of the symptom Wilcoxon Sign test was performed where,

$$r = \frac{(n-1)}{2 - k\sqrt{n+1}}$$

Where, k = 0.98 for the 5% level of significance.

Table No. 5: Excessive Salivation with Metallic Taste

Criterion	No. of Volunteers	Percentage	Sign Value
Excessive Salivation with Metallic Taste	04	13.33%	S = 04, r = 8.37, s < r p>0.05
	26	86.66%	

Therefore, the data is non-significant for 5% level of significance hence, H₀ is accepted.

2. Painful inflamed gums:

Only 2 patients among 30 show painful inflamed gums. This is also very important symptom of mercury poisoning.

Table No. 6: Painful inflamed gums

Criterion	No. of Volunteers	Percentage	Sign Value
Painful inflamed gums	02	13.33%	S = 02, r = 8.37 s < r p>0.05
	28	86.66%	

Therefore, the data is non-significant for 5% level of significance hence, H₀ is accepted.

3. Irritation of Skin:

Irritation is an important symptom in any irritant poisoning. Heavy metals are irritant poisons as well. In this particular study the symptom skin irritation is seen in only 7 volunteers.

Table No. 7: Irritation of Skin

Criterion	No. of Volunteers	Percentage	Sign Value
Irritation of skin	07	23.33%	S = 07, r = 8.37 s < r p>0.05
	23	76.66	

Therefore, the data is non-significant for 5% level of significance hence, H₀ is accepted.

4. Hatter's Shake:

Hatter's shake are the characteristic fine tremors in bilateral upper and lower extremities of the patient of Mercury poisoning. 2 volunteers among 30 shown these characteristic tremors. Table 8: Hatter's Shake

Criterion	No. of Volunteers	Percentage	Sign Value
Hatter's Shake	02	13.33%	S = 02, r = 8.37 s < r p>0.05
	28	86.66%	

Therefore, the data is non-significant for 5% level of significance hence, H_0 is accepted.

5. Urine Analysis:

This was the only objective criterion in this study. Urine sample of each and every object (Volunteer) was analyzed for mercury remnants in the standardized laboratory. No sample found to have more than normal range of mercury level.

6. Other symptoms viz. Nephritis, mercuria lentis and Erethism were not seen in any volunteer during study.

Discussion:

No subjective or objective criteria in this study is significant that means showing that some specific factor i.e. mercury poisoning is responsible for the incidence of the criteria and hence those are by chance only. But previous studies interpret that working in the fumes of mercury amalgams causes chronic poisoning of mercury. Still in this study no one criterion shows significant incidence. This may be because of the precautions they are taking while working in the dental laboratories which includes wearing of personal protection kit i.e. Masks, hand gloves, aprons, shoes etc. That makes the sense that working with proper precautions in the Mirror industry with amalgams does not cause any harm of acute or chronic mercury poisoning.

Conclusion:

All the above observations and statistical analysis show that H_0 i.e. null hypothesis is accepted because all the symptoms which are positive are not significant and occur by chance in the observation group. Therefore H_1 i.e. alternate hypothesis is rejected.

References:

1. Rasarnva 17/162, Ayurvediya Rasashastra, by Dr. Siddhinandan Mishra, Chaukhamba Orientalia publications, Varanasi, P.No. 169.
2. https://www.conservation-wiki.com/wiki/Tin-Mercury_Amalgam_Mirrors
3. Rasarnava 18/139, Ayurvediya Rasashastra, by Dr. Siddhinandan Mishra, Chaukhamba Orientalia publications, Varanasi, P. No. 330.

4. Bhaishjyarnavali Pa. Vi. Chikitsa, Ayurvediya Rasashastra, by Dr. Siddhinandan Mishra, Chaukhamba Orientalia publications, Varanasi, P. No. 335.
5. (Rasarnava 18/139, Ayurvediya Rasashastra, by Dr. Siddhinandan Mishra, Chaukhamba Orientalia publications, Varanasi, P. No. 330.)
6. https://www.conservation-wiki.com/wiki/Tin-Mercury_Amalgam_Mirrors

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