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Distribution of Fingerprint Patterns in North: Indian Population

Prasansha Singla

B.Sc. Forensic Science, Amity University, Panchgaon, Manesar, Gurugram, Haryana 122413, India

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Abstract

The study of epidermal ridge pattern of finger, sole and palm is known as Dactylographic or Dactyloscopy. The Dactyloscopy relays on the analysis on the pattern type. There are greater and progressive advancement in the field of forensic fingerprint and technologies related to this analysis like recording, lifting, and developing of prints under different conditions. Fingerprints are the chief and paramount importance in the field of forensic investigation. These are unique, difficult to alter and durable over the life of an individual. Identification using the fingerprints is outright and unerring. At the crime scene, identification can be made by comparing very small portion of ridges left. The present study was carried out among 500 peoples, 250 males and 250 females of North Indian population belonging to age between 10-80 years with the aim to found the most popular pattern found in North Indians mainly Haryanvi's. The rolled fingerprints were taken using by the ink method and their patterns were identified. This prospective study was carried out over the period of approx 6 months. The results showed the majority of population having the Loop pattern that is 57.5% of total population.

Keywords: Dactyloscopy; North Indians; Loops; Whorls; Arches.

Corresponding Author: Prasansha Singla, B.Sc. Forensic Science, Amity University, Panchgaon, Manesar, Gurugram, Haryana – 122413, India

E-mail: prasansha0828@gmail.com

Introduction

The study of ridge pattern of fingers, sole, and palm is known as Dactyloscopy. The word Dactyloscopy origin from the ancient Greek word (daktylos means "finger") and (skopeō means "look at").[1,2] It is the process of comparing two finger ridges skin impression are likely to have same origin or not. Fingerprints is an impression of ridge outline which appears on the anterior surface of finger of the proximal, middle and distal phalanges and same on the thumb.[3,6] It is the raised portion of epidermis on the finger and toes and these ridges sometimes also known as epidermal ridges. These are reproduction of friction skin ridges present on the palmar of hand and sole of the feet.[7] These ridges designed to provide former grip and resistance to slip. The pores present in between of these ridges,from which perspiration is discharge due to which impression was deposited on the surface.[4,5] The study of pores is known as Poroscopy. The science of Poroscopy was established in 1912 by Sir Edmond Locard in France.

The fingerprint is one of the most important and valuable evidence which is generally find at the place of the scene of crime. It is so important due to their uniqueness, availability, universality and permanency. Fingerprint evidence is perhaps the most common type of physical evidences found at the crime scene.[8,11,13] Their development and identification helps to prove criminal physical presence at the scene of crime. It is extremely difficult for the criminal to commit the crime without leaving behind his fingerprints in cases such as theft, burglary, house breaking etc.; unless

they wears gloves but from the gloves also there are chance to lift the prints. Since the ridges present on epidermal surface of finger and palm emit a film of perspiration of oily matter. There is a tendency for ridge impression to adhere to non-porousobject that person may touch.[9,10] On the basis of visibility, fingerprint can be classified into 3 categories i.e. Patent, Latent and Plastic. The forms of latent prints sometimes smudge, partial, incomplete left as crime scene unknowingly or by chance by peritrator.[12] So the present study is an attempt to the determined the distribution of the different kind of patterns among the population of north Indians mainly people belong to Haryana.

Material and Methodology

The aim of the study is to find out and analyse all ten digit fingerprints of an individual and analyse different patterns among the different age groups. The main aim to understand the big picture of fingerprints taken from 500 Haryana citizens mainly from Faridabad and Gurugram in which 250 are females and 250 are males aged belong to 10 to 80 years were taken in the month of December to May in year 2019–20. The whole study takes the time of aprox 6 months.

The materials used in the study were black ink, magnified lens, pencil and performa. The entire sample was taken in fingerprint card (shown in fig. 1). The inkless fingerprint pad was used for taking prints

People with any kind of deformities, permanent scars and any extra finger or bandage finger were excluded from the study. The verbal content of all the subjects was obtained after properly explanation about the objectives of the study to them. The entire subjects are requested to wash their hand with the ether or alcohol and dried completely to remove dirt, grease and sweat. In this study take the rolled fingerprint, all ten digits; rolled from nail to nail. Then the plain impressions are used to verify the accuracy of rolled fingerprints. The subjects are allowing rollingof their fingers in the ink pad and then allow rolling it on the given space in the fingerprint card. Roll the finger on the ink pad in such a way that entire fingerprint pattern area is evenly covered with the ink. Ink should be covered from one edge to the nail to the other and from the crease of the first joint to the tip of the finger. The limited amount of ink was used with the limited pressure. During the time of lifting of fingerprint on the card extra care should be taken to avoid the smudging. All the 10 digits fingerprint was taken in the same method and at last plain impression were taken. In this individual's finger, keeping together and press on the paperin their allotted space after applying on the ink. Repeat the same process for the both thumbs.

After the fingerprint acquired, personal detail such as subject's name, age, sex, height etc. were taken with their signatures. Each subject assigned the serial number. In last prints that were taken were analysed under a magnified lens and studied

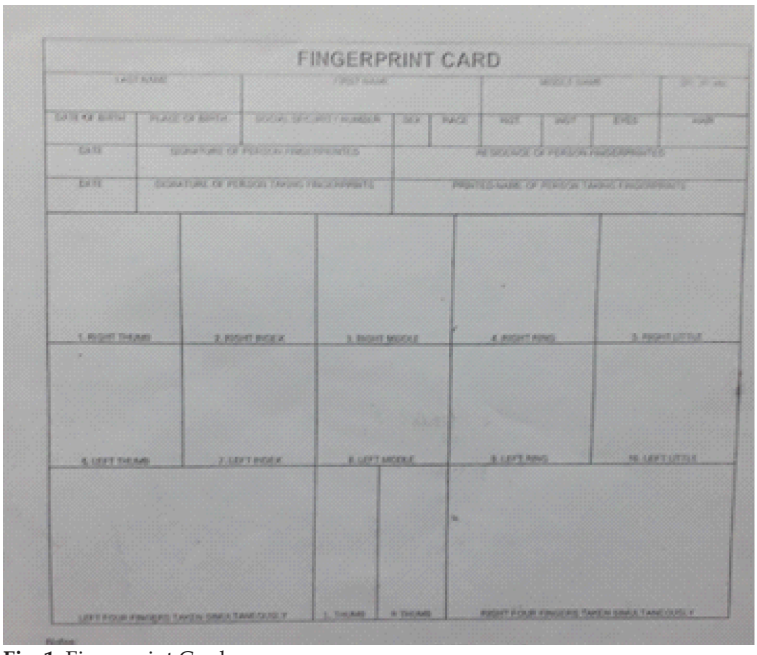


Fig. 1: Fingerprint Card

for indentified for patterns i.e. Loops, whorls, and arches based on the appearance of ridges lines.

Result and Observation:

Table 1: Distribution of primary fingerprint patterns among the subject.

Fingerprint Pattern	Total Number	Percentage
Loop	2875	57.5%
Whorl	1340	26.8%
Arches	165	3.3%
Composites	620	12.4%
Total	5000	100%

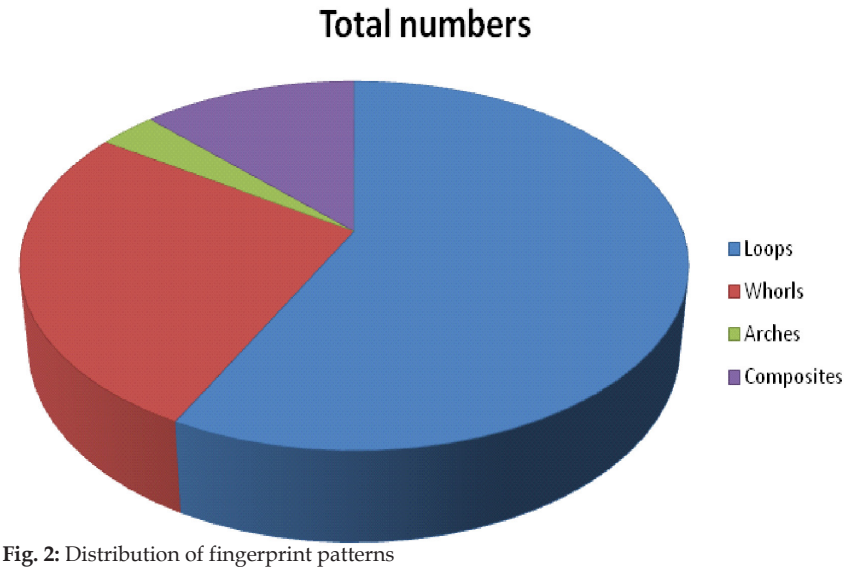
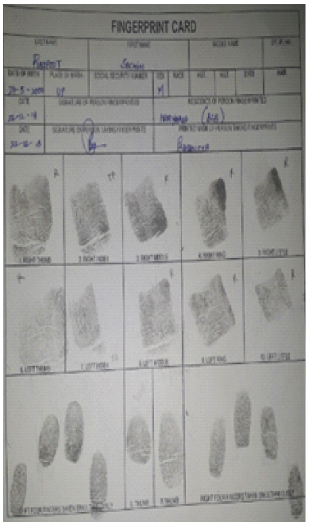


Fig. 2: Distribution of fingerprint patterns

Table 2: Distribution of loops, whorls, arches and composites with their percentage.

Digits		Number	Loops	%	Whorls	%	Arches	%	Composites	%
Thumb	Right	500	275	55.0%	170	34.0%	0	0.0%	65	13.0%
	Left	500	324	64.8%	127	25.4%	1	0.2%	56	11.2%
	Total	1000	599	59.9%	297	29.7%	1	0.1%	121	12.1%
Index	Right	500	243	48.6%	149	29.8%	49	9.8%	53	10.6%
	Left	500	212	42.4%	156	31.2%	53	10.6%	60	12.0%
	Total	1000	455	45.5%	305	30.5%	102	10.2%	113	11.3%
Middle	Right	500	357	71.4%	63	12.6%	15	3.0%	104	20.8%
	Left	500	307	61.4%	99	19.8%	15	3.0%	106	21.2%
	Total	1000	664	66.4%	162	16.2%	30	30.0%	210	21.0%
Ring	Right	500	215	43.0%	216	43.2%	9	1.8%	40	8.0%
	Left	500	224	44.8%	209	41.8%	2	0.4%	77	15.4%
	Total	1000	439	43.9%	425	42.5%	11	1.1%	117	11.7%
Little	Right	500	372	74.4%	59	11.8%	19	3.8%	24	4.8%
	Left	500	346	69.2%	92	18.4%	2	0.4%	35	7.0%
	Total	1000	718	71.8%	151	15.1%	21	2.1%	59	5.9%
Total	Right	2500	1462	58.5%	657	26.3%	92	3.7%	286	11.4%
	Left	2500	1413	56.5%	683	27.3%	73	2.9%	334	13.4%
	Total	5000	2875	57.5%	1340	26.8%	165	3.3%	620	12.4%



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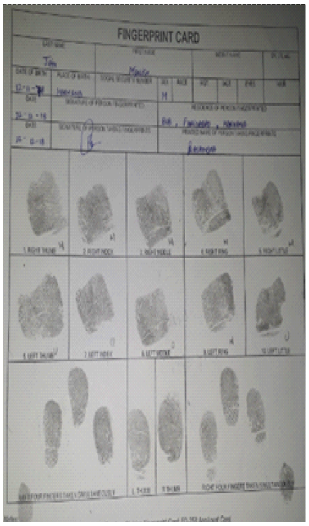

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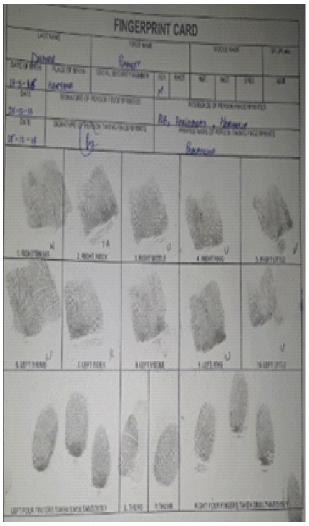

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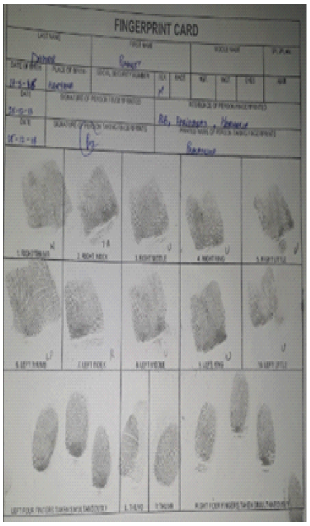

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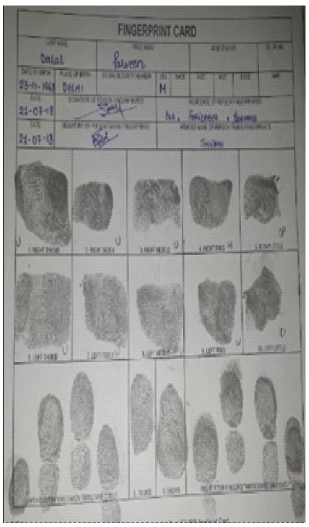

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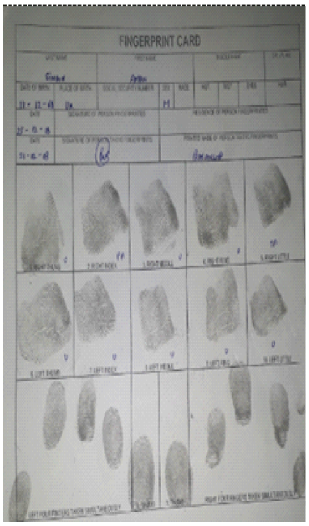

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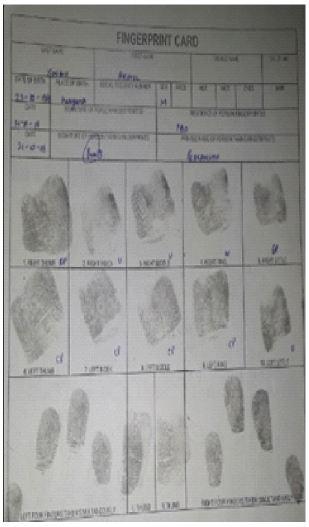

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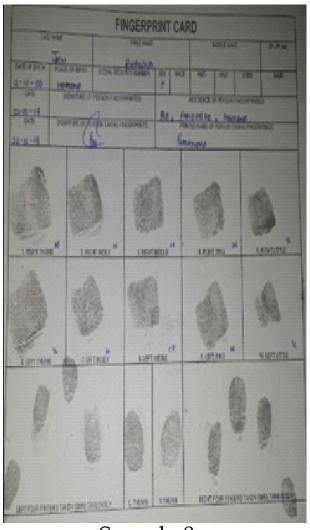

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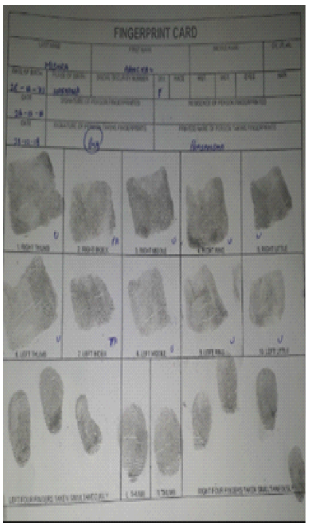

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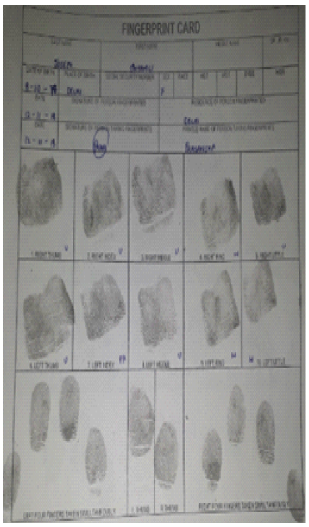

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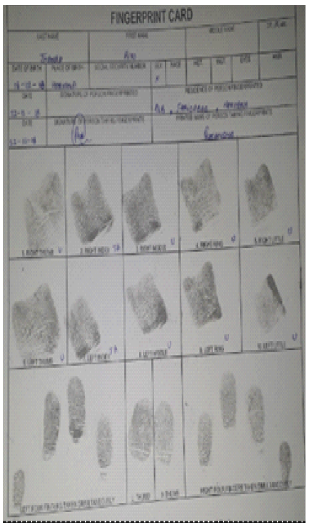

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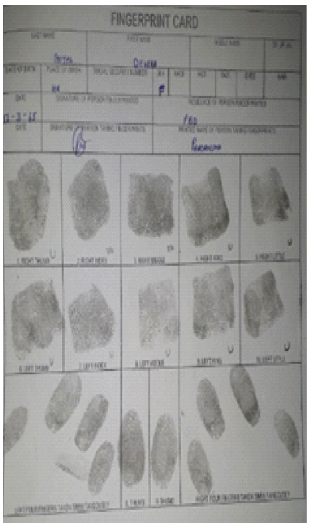

Sample 12

Table 3: Showing some of the Fingerprint sample taken from the North - Indian population

Discussion

Fingerprint pattern are very unique and remain unchanged throughout the life. Even the two identical twins don't have the same fingerprints patterns. Hence, it plays a very important role in forensic investigation. The first work was done in the China, aprox 3000 years back, to sign the legal documents. After that there is a long history of the fingerprints but the main and most important event take place when Bertillon began his work on the fingerprint system. William Herschel, British civil servant, started fingerprints for personal identification, i.e. mainly right hand imprints to sign the legal contracts but that time his motive remain unclear. The advantages of using the fingerprint pattern as a mean of identification. After that Faulds work on the fingerprint and suggest that there is different kind of fingerprint patterns or ridges which gave important in the investigation of criminals. The system of classification was given by Sir Francis Galton, by published his book on "Finger Prints" and this classification is even use today, is a modified version of the system proposed by Sir Francis Galton and was modified by Sir Edward Henry and this classification is known as Henry's System of Classification or Henry Galton method. This is the most effective and efficient method use by almost all over the universe. There are four basic fingerprint patterns which are used in this study which are:Loops, Whorls, Arches and Composites. Loops can be seen in almost 60 to 70% of the world population fingerprints. Loop can be distinguished by how the loop flows on the hand. Loop pattern has one delta and one core. There are 3 types of the loop pattern i.e. Ulnar loop, Radial loop and Double loop. Arches are the least seen among the population. It's about only 5 % and there is no delta. The ridges run continuously from one side to the other side of the finger. There are 2 types of arch pattern i.e. plain arch and tented arch. Whorls can be seen in about 22 to 30% of the fingerprints. Pattern that contains two or more deltas will be a whorl and can be categorised in 3 groups, i.e. plain whorl, central pocket and accidental.

Conclusion

The present studyprominence that the loop patterns are the predominating and arches are the least occurring in the North Indian population. It may help in increasing the authenticity of fingerprints in identification of individuals and solving of crimes. The result was obtained that in the overall population loop pattern have the highest frequency i.e. 57.5% and the arches having the lowest frequency i.e. 3.3%. The whorls contain the 26.8% of total population. In table 2, Loop patterns were prevalence in the Little finger and in the middle finger but the Whorls were prevalence only in the ring finger. Arches were more seen in the index finger and composites were mostly found in the middle finger. Thus, different pattern were seen their preferences in the different digits.

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Review Article

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Mapping Toxic Disasters around the Globe: An Indian Society of Toxicology Initiative for Legal Regulation on Environmental Toxicity

Vivekanshu Verma[1], Vijay Vasudev Pillay

[1]Fellow of India Society of Toxicology, Associate consultant, Emergency and Trauma care medanta- The Medicitu, Gurugram, [2]Chief, AIMS Poison control centre, Proferssor & head forensic medicine &Toxicology Amrita School of Medicine Amrita Vishwa vidyapeetham, Cochin, kerala

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Abstract:

Mapping Toxic Disasters, based on the past incidences becomes relevant. So, the Toxic Map is prepared by the indian Society of Toxicology to call out the emergency medical services to prepare for managing the future toxic disasters, based on the common toxins in that region, easily available to the vulnerable population .The goal of the initiative is to prioritize toxic xenobiotic substances for further in-depth toxicological evaluation as well as identify their pattern of availability in the environment, in their region of production, consumption or improper disposal, and further prevention of such as toxin-associated morbidity & mortality in community, leading to mass casualties, since the time immemorial.

Keywords: (Toxicity, Map, Atlas, Global, disaster, environment, Health, safety, prevention, preparation, Hazardous)

Introduction

Environmentally Toxic Exposures: A to Z in environmental toxicity caused by CBRNE.

CBRNE stands for:

- *C-Chemicals*- HOOCH - Methanol, ethylene glycol;; OPC (Organophosphates)- Tabun, Sarin, Soman; Methylene Isocyanante (MIC)- Bhopal gas; Cyanide/ CO/ H2S gas
- *B-Biological* – Anthrax, Smallpox
- *R-Radiological* – Radioactive heavy metals- Polonium
- *N-Nuclear Disasters*- Hiroshima Nagasaki in Japan
- *E-Explosives*- Iran Iraq War

Search for Toxic look- alike, Toxic sound- alike, Toxic taste- alike, Toxic smell-alike on & around the victim, after checking scene safety as per WHO protocol: Dr.ABCDE (easy recall as name of some unknown doctor)

This follows the general principles of life support given below:

- Dr-ABCDE
- D - DANGER - scene safety- Radiation/ Hazardous chemical/ Cyanide/CO/H2S gas
- R - RESPONSE- call for help
- A – AIRWAY secured & maintains patency/ Antidote
- B – BREATHING support
- C – CIRCULATION maintain access
- D - DISABILITY/ Decontamination- Whole body
- E – EXPOSE THE PATIENT completely- to find poisonous bites/stings
- F- Foley's catheterization for rapid excretion of toxic metabolites
- G-Gastric lavage for decontamination
- I- Isolation of patient & I-Intermittent rotation of Health Care provider to prevent further spread of toxicity to others (occupational hazards)

Corresponding Author: Vivekanshu Verma, Associate Consultant and Fellow, Department of Emergency and Trauma Care, Medanta - The Medicity, Gurugram, Haryana 122001, India.

E-mail: vivekanshu@yahoo.co.in

Mapping Atlas of Toxic Disasters around the Globe Indian Society of Toxicology

North West (Europe)	North (Ukraine-Russia- Siberia)	North East (China, North Korea)
• Jewish German Holocaust- Cyanide Gas1 • Toxic chemical spill (Switzerland)2Rhine Red, Fish Dead (organophosphate insecticides, mercury compounds & Organochlorines)[3] • Notre Dame Holy waterpoisoning in Paris • Dioxin- Seveso industrial disaster-Italy[17] • Huelva mines- Metal fume toxicity in Riotinto[33]	• Chernobyl Nuclear Disaster –Ukraine radioactive metal toxicity[8] • Rum Whiskey intoxication • Rasputin Execution failed – Cyanide laced Rum-Cake[1]	• Opium-silk route (Golden Triangle)[23] • Baotou toxic lake: man-made lake of toxic waste[18]
West (North America – USA, Mexico, Canada)	**Central (Middle East,Africa-Arabia-UAE)**	**East (South Korea Japan)**
• Battery lead contamination-Industrial Lead toxicity in Los Angeles, California[4] • Greenpoint Oil Spill – Brooklyn, New York[5] • Toxic Potato Salad (Ohio)- Large outbreak of botulismassociated with a church potluck[6] • Bitter Coffee at Church Breakfast-Cyanide Tragedy[7] • United States of Toxins– Utah & Nevada-metal mining- metal fume toxicity[20] • Iatrogenic Opioid Epidemic [24]	• Lily of the Valley[28] • Mad-Honey, bee and wasp stings • Cantharides • Golden Crescent- Opium (Afghanistan-Iran-Pakistan)[25] • Carbon monoxide – Gas Heaters[27] • Apricot- Cyanide[1]	• Red-tide + Harmful algal bloom in sea coast in summers[29] • Seafood poisoning – Fugu, Ciguatera • Sarin (OPC) Tokyo Subway - Bioterrorism (641 victims)[15] • Fukushima Daiichi nuclear disaster[16] • Cadmium toxicity - Itai-itai disease- "it hurts-it hurts disease" Jinzu river basin-Toyama Prefecture, Japan[35] • Methyl mercury- Minamatadisease [18,19] • Hiroshima Nagasaki Nuclear Attack & resulting toxicity in Japan[37]
South West (South America, Brazil, Peru, West Indies)	**South (Australia, South Africa)**	**South East (Asia –India- Malaysia, Cambodia, Thailand, srilanka)**
• Black widow Spider • Black scorpion • People's temple massacre -Cyanide laced drinks1	• Rattle Snake and Coral Snake[32] • Ivory Coast toxic waste dumped of toxic oil sludge • Esperance's lead poisoning disaster[21]	• Opium (Golden triangle) India-China- Malaysia-Thailand[22] • East India: toxic runoff of Arsenic, Pesticides[26] • India, Srilanka- Cobra, Viper, Krait[1] • Western Ghats- Red scorpion[2] • HOOCH Tragedy- Methanol Country Liquor-Malaysia, India • Methyl IsoCyanate (MIC) Bhopal Gas Tragedy- World's Worst Industrial Disaster • South India: Cyanide Tragedy by Goldsmith's powder (KCN)- Cyanide Mallika[9,10,] Cyanide Mohan[11,] Cyanide Jolly-killer of kin- Soup[12]. • Cyanide Rash- Cassava tubers, Tapioca • Karnataka-Pesticide casualty - Holy Prasad[13] • Carbon monoxide epidemic in winters–Sigdi, Kangri Gas Geysers

Rx- Decontamination & Antidotes in HAZMAT protocol:* ABCDEFGHIJKL

- A-ALARA (As Low As Reasonably Achievable) principle
- A-Antidotes (Atropine/ PAM/ NAC/ KI) / Activated charcoal / Antibiotic prophylaxis for immunocompromised
- B- Blocking absorption (Radioiodine absorption blocked with potassium iodide),
- B-Bronchoalveloar lavage for removing inhaled HAZMAT
- C- Chelating agents for radioactive metals (Prussian Blue chelates Caesium & Thallium; DTPA chelates Plutonium, Americium, Curium)
- C-Counters of counting toxic radiation dose
- C-Cytokines /CSF (Colony Stimulating factors) for managing low Blood counts
- D- Decontamination of clothes, hair / Detoxify / DMPA / Dosimeters
- E- Emesis timing prognosis/ Exposure/ Elimination by Dialysis / EDTA
- F-Foley's catheter- 24 hr urine collect
- G- Gastric lavage within 1 hour
- I-Isolation of patient, his waste, his clothes/ I-Isotopic Dilution
- J-Judicious investigations of all body fluids
- K- KI for Radio iodine
- L- Lymphocyte count depletion\

PPE (*Personal-Protective-Equipment*) for HAZMAT Team handling victims:

HAZMAT- stands for HAZardousMATerial: radiotoxic solids/liquids/Gas

- A-Aprons of Lead

- A-Air Purifying Respirator(APR)
- B- Breathing Apparatus
- B- Booties of Rubber/Leather upto the knees
- B- Biohazard bags with International Biohazard Sign for collecting samples/ disposing the contaminated clothes/ liquids.
- B-Barrier creams - toothpaste applied around eyelids
- C- Caps of plastic for Head
- C-Chemical resistant clothing (overalls and long-sleeved jacket, coveralls, hooded two-piece chemical splash suit, disposable chemical resistant coveralls
- C-Closed-circuit type filters, supplements, and recirculates exhaled gas.
- C-Compressed Air Breathing Apparatus (CABA) or self-contained breathing apparatus (SCBA) is a Positive pressure device worn by HAZMAT rescue workers, firefighters, and others to provide breathable air in an immediately dangerous to life or health atmosphere. SCUBA (Self-Contained Underwater Breathing Apparatus) has cylinder to go inside deep waters.
- D-Decontamination Showers after handling the suspected victim
- D- Dosimeters should be worn at the neck for easy access by the RSO(Radiation safety Officer)
- E- Eye shield & Ear Plugs in noise reduction in industrial safety
- F-Face Shields for splash/ burst of container
- F-Footwear protection (Disposable)
- G- Goggles (Lightweight, Reusable, Indirect Vented (Splash proof),Clear Vision with a Wide Flange and Latex-free) for examining radioactive substances
- G-Gloves of Yellow Rubber
- G-Gown of plastic covering whole body- like astronaut dress
- H-Helmets to safeguard from Head injury in extrication of victims from collapsed vehicles/ buildings
- H-Hood mask with Oxygen cylinder, for going inside closed spaces with toxic fumes
- H-High visibility clothing- fluorescent stripes
- I-Isolation

PPE is divided into four categories based on the degree of protection afforded.

1) Level A protection should be worn when the highest level of respiratory, skin, eye and

Fig. 1: Hazardous material disposition in coloured bins (Cited from our book on Critical care nursing in Emergency toxicology)

mucous membrane protection is needed.

2) Level B protection should be selected when the highest level of respiratory protection is needed, but a lesser level of skin and eye protection is needed.
3) Level C protection should be selected when the type of airborne substance is known, concentration measured, criteria for using air-purifying respirators met, and skin and eye exposure is unlikely.
4) Level D protection is primarily a work uniform and is used for nuisance contamination only.

Discussion

Mapping Toxic exposures is utilised by crime investigation agencies like CIA (Central Investigating Agency) of America, and thus the terms has come: Golden crescent & golden triangle of Opium trafficking.

Crescent moon symbolises Islamic Republic-Afghanistan, Pakistan Iran, have crescent moon in their flag, calendar is based on the moon waxing & waning, and opium is sold & supplied in exchange to gold at high price illegally from these countries, so its nicknamed as golden crescent.

Toxic Runoff during Floods: The inundation of an area with water can cause chemical release in other ways. In rural areas, runoff from flooded areas can carry with it eroded soil containing fertilizers, herbicides and insecticides. Runoff from motorways, roads and bridges may contain heavy metals, petroleum hydrocarbons and polycyclic aromatic hydrocarbons. Runoff from inundated waste sites may contain a variety of toxic chemicals, depending on what was stored on the site. Arsenic Floods in Rice Harvest in East India. Some crops, such as rice, absorb arsenic easily, leading to contamination in the food chain. An estimated 1,360 tonnes of arsenic are pumped up by the tubewells and added yearly to the fertile soils here. For the last two decades the world has been trying to explain how arsenic leaches into groundwater in the Ganga-Meghna-Brahmaputra floodplain. The latest research says floodwaters can remove arsenic.

Carbon monoxide poisoning during floods and winters: Carbon monoxide poisoning resulting from the incorrect use of fuel burning generators for electricity, barbeques, braziers or buckets of coal or charcoal for heating and cooking, or petrol-driven pumps and dehumidifiers to dry out flooded rooms. CO poisoning must form part of syndromic (Toxidrome) and event based surveillance systems for flooding and should be included in measures of the health impact of flooding.

Fig. 2: Toxic Calendar by Indian Society of Toxicology

On August 20, 2006, toxic waste was illegally exported from Europe by multinational trading company and left in Akoudo, a dump site in the middle of a poor residential area of Abidjan, and in 18 other sites in the city. Tens of thousands of people suffered severe health effects and 15 to 17 people died. The waste was produced from unrefined gasoline by a process called caustic washing, a process banned by most countries. Ivorians staged protests and demonstrations in the city following the dumping.[32]

In Japan the most heavily cadmium (Cd)-polluted region is the Jinzu river basin, where Itai-itai disease is endemic and the Kakehashi river basin is the second most polluted region.. The village average Cd concentrations in rice were distributed in the range between 0.02 microg/g and 1.06 microg/g in the Jinzu river basin and 0.11 microg g and 0.67 microg g in the Kakehashi river basin. Severe renal damage has occurred widely in the Jinzu river basin. Dose-response relationships between Cd exposure and health effects were clearly demonstrated in both regions.[35]

Hazardous-Material* disposal- HAZMAT Protocol of Colour Coding of *Bio-Medical-Waste*(BMW) disposal bins inside Hospital.Easy recall colour of BMW disposal bins inside Hospital: Coloured Bio Medical Waste (BMW) bag disposal as per indian Bio-Medical Waste Management Rules, 2016.[36]

- R-*Red-Bin*- *Recyclable* waste(R-R)- *Red* blood soaked (used) *Rubber* gloves, Rubber & Plastic tubes & IV sets.
- Y-*Yellow-Bin*- pus(Yellow) soaked Cotton Gauze pieces & dressing, Microbiology Waste (infected pus(Yellow) producing Bacteria), Human anatomical waste (tissues, organs, fetal parts)- infected (pus filled -Yellow), Animal waste, Empty Blood bags, soiled (Yellow) linen & Contaminated Bedsheets, discarded cytotoxic drugs for Burning infective waste in Yellow fire during inceration.
- W- *White Puncture-Proof-Bin* - Whole (unbroken) metallic (White) needles, blades & sharp waste.
- *Brown-Cardboard-Box* with *Blue-Marking*- Unbroken Broken glass (Nukila Glass in Neela (Blue lining Brown Box)) & Body implants(metallic).
- *Black-Bin*- Black & white paper(non-infectious) waste- paper wraps & medications boxes of paper, tissue paper after drying washed hands.

We must underline the fact that the toxicology experts developed their assessment, identification, intervention, investigations & management in a highly charged toxic environment, causing secondary exposure to the toxins, in which arguably several strong stakeholders from the commercial industry & politics intervene, not only in establishing new regulations but also in defining risk.The lessons learned from establishing the cohorts and the pioneering analyses by Toxic detective scientists should serve as a legacy for future generations who experience occupational, medical, or environmental radiation exposures.[37]

Updates on Workshop Proceedings for preparation and prevention of Toxic Disasters

Recently Our Toxic detective course by Indian Society of Toxicology (IST) was successful & houseful with 31 participants from all over India & abroad–Nepal (Students of Forensic Science, Forensic Medicine, Law students, and all interns, paramedics and Toxicology Nurses) and 20 faculties from all over India & abroad–Nepal, so our course by IST became internationally recognised & accepted for preventing mass disasters. It was interactive & informative as per feedback of participants & faculties. We completed it as per schedule of one day. This course was targeted for all the professionals, engaged in handling toxicological emergencies of any kind, and took this workshop as a learning experience, and the training on simulation as an introduction to Crime Scene Investigation & Environmental Toxicology.

We conducted pre & post Tests by using Online Google form, so everyone on the whatsapp group of Toxic detective could access by filling his name & email ID. That prevented wastage of paper and gives easier analysis.

Their Prestest & Post-test results comparison showed the positive impact of our unconventional method of teaching by using hand's on training on allowing all the participants to do analytical toxicology one be one on stage under supervision & guidance of the faculties. Hon'ble Past President of IST- Dr Prateek Rastogi Sir–(Kasturba Medical College, Mangalore), & Our Chief guest of honor-Respected Dr yatin Mehta Sir (Department of Critical Care, Medanta Gurugram), inaugurated the event by releasing the Toxic Calendar by Indian Society of Toxicology (Fig. 2).

For first time, our IST team demonstrated & taught the utilisation of pelvic binder in sexual assault victims bleeding by simulation on Barbie

dolls under supervision of Dr Richa Chaudhary, Associate Professor of Forensic Medicine & Toxicology at DrRMLIMS, Lucknow & Dr Vidusha Vijay, Department of Forensic Medicine & Toxicology, Victoria Hospital, Bengaluru. We kept the artificial decorative plants, roots, fruits & berries for learning botanical identification of toxic plants, on which Dr PriyamwadaKurveti, Associate Professor of Forensic Medicine & Toxicology, Gandhi Medical College, Bhopal educated the participants' alongwith Dr Ramesh K Maharjan, Professor of Emergency, Tribhuvan University, Nepal.

Similarly we used the animal toys of rubber to educate identification of the venomous snakes, scorpions, spiders, insects, sea-fishes causing toxicity taught by Dr Shiuli Rathore, Assistant Professor of Forensic Medicine & Toxicology, KGMC, Lucknow along with Dr RK Gorea, Professor of Forensic Medicine & Toxicology, Gian Medical College, Punjab & Parmod Goyal, Professor of Forensic Medicine & Toxicology, Adesh Institute of Medical Sciences & Research, Bathinda.

For simulating drugs of abuse, we kept the different coloured powders (salt, sugar, brown sugar, talcum powder) to get the visual identification of common drugs prepared illegally to bypass the legal regulation of NDPS and prevent being caught, as they look harmless household products.

Dr Amita Srivastava, Senior Scientist of AIIMS Poison Information Centre, Delhi&Dr Shikha Tandon, Consultant of Emergency, Fortis Hospital,delhitaught about antidotes by keeping their branded medication boxes with smiles &dingling eyes, talking to the participants (done by faculties holding in their hands the antidote box) and telling the indications, contraindications, method of administration.

20 Colour tests by World Health Organisation (WHO) to identify the common poisons were demonstrated live by Dr Arun Kr. Harith, Senior Consultant of Biochemistry, Medanta the Medicity, Gurugram alongwith Dr Pallavi Jain, Assistant consultant of Biochemistry, Medanta the Medicity, Gurugram.

Our IST team conducted role plays of toxic disasters by volunteers from emergency, biochemistry, Forensic Medicine, forensic science, law students, who volunteered for the event role plays on Hooch tragedy and antifreeze toxicity among kids-performed very well by all including Ms Richa thakur, Emergency nurse, Medanta Medicity, along with Tincy, Reena, Rajni-our emergency nursing officers under direction of Dr ArjitDey, Senior Resident from Forensic Medicine & Toxicology, AIIMS Delhi.

On behalf of Department of Emergency & Trauma Care, Medanta Medicity, We have scheduled similar Toxic detective course 2020- Masterclass & workshop by IST, on the auspicious occasion of World Health Day-7th April 2020 at Medanta Medicity Gurugram, to learn toxicology in a day.

Conclusion

Toxicity mapping is very important aspect of preventive toxicology. So, the Toxic map is prepared by the Indian Society of Toxicology to predict the common poisonings & call out the emergency medical services to prepare for managing the toxic disasters, based on the common toxins in that region, easily available to the vulnerable population. Among its many applications, toxicity prediction by Toxic map can reduce the cost and labor of Medical Services in the long run, by preventing the morbidity & mortality of innocent victims.

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Review Article

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Significance of Treatment Consent, Pre Interaction work up and Clinical Documentation During COVID-19 in Dental Clinics

Abhimanyu Sharma[1], Sunil Chaudhary[2], Ishaan Chawla[3], Shrish Gautam[4], Jyoti Ahlawat[5]

[1]Senior Research Associate, Department of Oral and Maxillofacial Surgery, ESIC Dental College and Hospital, New Delhi, [2]Associate Professor,Department of Oral Medicine, ESIC Dental College, New Delhi, [3]Advocate, Delhi High Court, New Delhi, [4]LLB Resident, Institute University, Bhopal, [5]Consultant Endodontist, New Delhi.

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Abstract

Consent from the patient is a very pertinent part of clinical case taking. It is in the patient's right to know about the treating doctor, facilities in the clinic and the treatment procedure that is to be performed. Informed consent between the doctor and the patient should be mutual and explained to the patient in his own language or a language he understands. Consent is a very important aspect of maintaining medico legal records along with treatment notes, radiographs, clinical pictures and prescription record of the medicines prescribed. Medico-legal incidents around the globe have become increasingly common. Informed consent and maintenance of clear records will unequivocally benefit both the doctor and the patient.

The COVID-19 has posed a threat to countries globally and governments and health authorities all over the globe have issued stringent guidelines regarding treatment modalities of varying medical conditions, judicious selection of cases according to priority as well as the added responsibility of the health worker to inform the authorities about any probable or confirmed COVID case. This in turn will help contain the cases within a restricted area. Authors believe that an exclusive COVID-19 consent form is the need of the hour along with routine consent for a prevention of negligence and prevention of medico-legal infringement of laws.

. **Keywords**: COVID-19; Medico-legal; Consent; Negligence; Medical Records.

Corresponding Author: Abhimanyu Sharma, Senior Research Associate Oral and Maxillofacial Surgery ESIC Dental College, Rohini, New Delhi .

E-mail: asmaxfac@gmail.com

Introduction

It will be a matter of surprise if there is any health care agency in our nation, which is operational without practising the philosophy of Informed Consent and Proper Documentation of details of Patients and their treatment.

Both Consent forms as well as Case documentation serve multiple purposes, such as, legal protection for both patient and doctor in criminal or malpractice case. Consent is not simply a form, it an assurance that ethical practice is being followed. Also, if consent is not given willingly or is refused, then fraud or deception can be suspected and noted.

Informed consent has been called a "fallacy of law" since it is impossible for a patient to understand the risks and benefits of a procedure from the standpoint of an expert.[1] However, it is an extremely advantageous process, from a therapeutic or communication standpoint, since it helps the patient understand why a procedure is necessary. Understanding will increase patient compliance or consequence.

It is very important for the treating doctor to properly document the management of a patient under his care. Medical record keeping has evolved into a science in itself. These documents in today's times are vital evidence for a doctor to prove that correct advice was given, the consequences of the treatment was in the knowledge of the patient and/or the treatment was carried out properly in cases of alleged negligence by doctors, which if proven guilty, leads to suspension of medical license.

Therefore, keeping physical or electronic records of the patients not only protects the doctors and their

reputation but also helps the patient in being more aware of their medical history. Moreover, it will also be of immense help in the scientific evaluation and review of patient management issues.

Medical records form an important part of the management of a patient, a properly obtained consent will go a long way in proving that the procedures were conducted with the concurrence of the patient. A doctor is the primary person who has to oversee this process and is primarily responsible for history, physical examination, treatment plans, operative records, consent forms, medications used, referral papers, discharge records, and medical certificates.

Keeping the aforementioned in view, the purpose of this paper is to explain and analyse the importance of consent and medical records with respect to COVID-19. The term "COVID-19" has become popular in the current scenario as the entire globe is struggling and putting up a fight against the pandemic to the best of their capacity.

COVID-19, as it is popularly known, is basically a contagious viral infection with mild to severe symptoms and clinical conditions such as fever, cough, respiratory distress and possible death. As per the existing knowledge, the virus spreads through droplet infection, which means that if a person infected with this virus sneezes, coughs or touches his face (specifically mouth or nose) and later comes into contact with tangible areas that are accessible by others, he ends up leaving traces of the virus which is when touched by others raises a possibility of spreading the infection.

Reportedly, the infection originated in the Wuhan Province of China, in the last Quarter of 2019 with its international presence being detected in a few countries by mid-January, 2020 post the celebration of Chinese Lunar New Year. By mid-March, almost 180 countries were affected.

It is important to note that as this is a rapidly spreading contagious viral infection, those countries that underestimated its consequences faced COVID related mortality in millions and deaths in thousands. It was only after the 11th of March, 2020 when WHO declared COVID-19 as a Pandemic (a disease which has spread across all geographic areas of the world) nations started becoming more vigilant about taking steps to control the spread of infection.

In India, a process called "Lockdown" was introduced from 23rd March 2020 onwards like many other nations doing the same before or after this date. A lockdown means a condition in which the citizens are requested to stay indoors, all modes of transportation cease to operate, all forms of public gathering for professional purposes (courts, offices, factories etc.) and personal gatherings (Marriage functions, funeral, rallies etc.) are put to hold. Only essential services such as Health Services, Defence, Police and Dairy and Food supplies are allowed to function. The aim behind doing so is to minimise inter personal contact at all levels, in order to reduce cross transmission of the virus leading to overall reduction of number of cases and to save healthcare services from being over burdened by the same.

After lockdown, one of the possible places for cross contamination are healthcare setups, specifically dental clinics, where there is abundant personal contact with the patient is if any treatment is needed.

To illustrate the seriousness of the situation, in case where a patient who is infected by COVID-19 but is yet to develop signs and symptoms happens to visit any healthcare facility may infect the doctor and supporting staff of the clinic by coming in their close proximity. The health care team which might get infected by this will happen to examine and help many other patients which may get contaminated and thus, it raises the possibility of further contamination of family members that may include minors and senior citizens who are more vulnerable and susceptible to catch the disease due to compromised or weak immune status.

In times when almost all services have ceased to be operational at full capacity with limited and only essential activities, health care centres can act as a gate way for cross contamination of this pandemic and arguably the onus of the same would lie with the doctor in-charge of that centre.

As we have already discussed the importance of Consent and Medical records, we would like to further highlight the significance and importance of exclusive COVID-19 form for Health care setups to be practiced before initiating any treatment of the patient with a purpose to withhold the spread of infection.

Elucidation:

In the wake of the prevailing COVID-19 situation and in order to strengthen the containment measures, it is of utmost importance that each and every case (suspects/confirmed) of COVID-19 is isolated and provided appropriate treatment and their contacts are traced at the earliest to break the

chain of transmission.

As per Government of India directives, it shall be mandatory for all hospitals both Government and Private (including private practitioners) to notify suspected COVID-19 affected persons to concerned district surveillance unit. All practitioners shall also get the self-declaration forms, who, within their knowledge, are having travel history of COVID-19 affected countries as per the extant guidelines and are falling under the case definition of COVID-19 (Suspect/Case) In case the person has any such history in the last 14 days and is symptomatic as per case the definition of COVID-19, the person must be isolated in the hospital and will be tested for COVID-19 as per protocol.

Information of all such cases should be given to the State helpline number and also to national helpline 1075 or to intimate by email at ncov2019@gov.in.

The Government has defined COVID-19 case as a patient with acute respiratory illness (fever and at least one sign/ symptom of respiratory disease (e.g., cough, shortness of breath) and a history of travel to of residence in a country/area or territory reporting local transmission as well as A patient with severe acute respiratory infection (fever and at least one sign/symptom of respiratory disease (e.g., cough, shortness breath) requiring hospitalisation and with no other aetiology that fully explains the clinical presentation.

Though with general consensus, directives of governing bodies and regulations of Govt of India, currently almost all dental clinics are either non-functional and dealing with patients on telephonic consultation to prescribe the needful medication through social media such as video calling, WhatsApp messenger or routine call. We would like to propose that for the purpose of records and documentation for future reference and medico-legal consideration, it is better if the Dentist can request for a written description of complaint through text along with best possible photograph from patient before concluding to a provisional diagnosis and prescribing medication.

In case of dental emergencies, the Dentists may have to address the patient clinically and in our understanding, sooner or later, dental clinics around the nation will start functioning as per the pre-COVID-19 routine.

If epidemiologists and experts are to believe this virus is here to stay for a long time thus keeping all the possibilities of spread awake irrespective of Restrictions on Transportations or Services thus the probability of possible COVID infected patients will remain alive.

Studies have shown that Dentists are among the most vulnerable professionals to get infected. This is because the virus tends to travel with aerosols from Naso-Oro-Pharyngeal Space through coughing, sneezing, spitting, or even breathing in case of high viral load; and almost all the clinical procedures in dentistry involves production of a high amount of aerosols. These aerosols may directly infect the dentist and supporting staff or may contaminate the interiors of dental clinic which ultimately will infect anyone who happens to visit the premises.

Any person may carry many morbidities at a point of time. for example a patient who is diabetic, can also be a heart patient, a patient of hypertension or cataract at the same time; likewise any patient who is visiting a dental clinic for any emergency procedure now or for an elective procedure once health services become fully operational, may happen to be a patient of COVID-19, a person with only initial symptoms of COVID-19 or may share proximity or relation with any demographic which can be a possible source of Virus which may raise a suspicion or maybe an asymptomatic carrier or the virus.

The team of authors after going through literature and discussion from the point of both medical and legal aspects suggests that it is crucial to introduce an exclusive COVID-19 Information cum Consent form in clinical practice where the ultimate onus lies on the clinician to keep detailed information. Dental clinics are vulnerable spots for transmission of the pandemic infection as they act as a bridge between an already infected patient and another patient who knowingly or unknowingly may get infected.

Routine consent form usually mentions the diagnosis, treatment plan, complications if any, along with treatment charges. This comes into picture once the consultation has been done by the doctor and the patient decides to go ahead with the needful treatment.

In our opinion, a COVID-19 Information and Consent form should be introduced in the clinic which should be given to the patient before starting of any sort of clinical interaction in person, even if it involves discussion of complaint on dental chair or entering the operatory.

The purpose of this form will be to look for any COVID-19 related sign or symptom which may or may not be present at the moment but can possibly occur in the future. It also checks if the patient

can be a possible carrier and at the same time to assure him that the doctors and their supporting staff are taking all due care and precautions while treating each and every patient and thus cannot be held liable later if an allegedly non-infected patient claims to have caught the infection from the dental clinic. Through this consent form, the patient will be legally bound to share all information, true to the best of his knowledge and hiding or misrepresenting any fact or intentionally giving false information can be an act of tort.

Depending upon the response, the dentist may decide to opt for a COVID-19 confirmation test prior to any dental treatment, or to keep the patient under observation for a couple of days for development of any sign or symptom of COVID-19 or may choose to inform the aforementioned authorities if deemed necessary.

Another significance of this Information cum consent form would be in case of detection of any COVID-19 positive case who happens to visit the clinic or turn out to be a patient infected with COVID19 within 14 days from visiting the dental clinic. The clinician may get himself and the supporting staff tested for the same. The clinician should also contact all other patients who visited the clinic around that time and request them to self-quarantine and check for any symptoms and visit a physician, if necessary. The dentist may also have to reproduce the entire data and details of patients being treated during that time frame to government officials to enable them to act, restrict and deal with possible cases.

The Authors are emphasising on noting and duly checking any Govt approved ID in the consent form as the possibility of people forging theform and details cannot be ruled out directly.

Having thorough details of all the patients will be great help to the Govt Officials and police to track down the source and act accordingly.

Discussion

India is a nation with population over 1.2 billion. We have people with all sorts of mind set and nature, and we believe that by introduction of this form we may not be able to directly control the disease but definitely stop the notorious and anti social mindset and would be playing our role in the prevention and restriction of spreading the disease by maintaining record of all patients addressed or treated on agreement of giving consent to this form.

It is essential for all dental clinics to strictly restrict to only emergency procedures, that too with use of proper PPE kit, sanitisation of clinic premises and autoclaving of all instruments.

We also advise all dental clinics to introduce a few norms such as one patient at a time, appropriate time gap between two patients, appointment so as to change the PPE and sanitisation of clinic premises, guidelines outside the clinic door so as to minimise hand to surface contact, etc.

Clinics should provide sanitisers and single use pens to be used for signature of consent to prevent patient to patient indirect surface contact. An Infrared thermometer and pulse oximeter would be a much appreciated step. Apart from this, an important task would be strict and proper disposal of bio medical waste and keeping record of the same. In case of any incidence of COVID-19 case detected in any one who works in the clinic or has been to the clinic, the doctor should inform the bio medical waste disposal vendor. As per the guidelines of Medical Council of India, all medical records should be maintained for a period of three years.

Conclusion

As a first line of protection against COVID-19 infection, pre-operative screening can be carried out relatively safely in the waiting areas of dental offices, thus filtering out the potential of cross infection to dental staff and other patients as well as their families from suspected or undiagnosed COVID-19 patients or carriers. Additionally, obtaining such detailed informed consent form exclusively for COVID-19 guidelines related information also addresses the medico legal aspects of dental interventions to safeguard the dental clinicians against misconduct or misrepresentation of information from the patients and the government health care system's concern in potentially identifying or isolating COVID-19 susceptible cluster areas in a population.

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Review Article

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Bite Mark, a Pivotal Tool in Crime Investigation: A Review

Anandita Kale[1], Namratha Patil[2]

[1]BDS Student, K.l.E. Vishwanath Katti Institute Of Dental Sciences, Kaher Belgaum, Karnataka, MDS- Lecturer, Department Of Oral Medicine And Radiology Vishwanath Katti Institute Of Dental Sciences

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Abstract

Objectives: Forensic odontology believes that no two oral cavities are similar in characteristics. Bite marks are imprint of the dentition of a human or an animal on a pliable medium. Analysis of these help in narrowing down the list of suspects. *Sources from which data was obtained:* Various news reports and criminal journals (both containing cases from within the country as well as worldwide) *Study Selection:* There are many factors and grades that are used to evaluate the authenticity of a bite mark. Various methods of documentation and evaluation are used to produce a scientific testimony in the criminal investigations.*Conclusion*: Some experts believe that bite marks are only beneficial to eliminate suspects and cannot be relied as concrete evidence due to distortion caused by human skin and the subjective judgement with which it is evaluated.

Keywords: Bite marks, Criminal Investigation, Forensic Odontology, American Board of Forensic Odontology (ABFO)

Introduction

"Science gave us forensics. Law gave us crime"- Mokokoma Mokhonoana[1]

A crime scene is a location where a crime took place and forensic evidence can be collected. Evidence collected can include fingerprints, footprints, blood and other fluids, any other DNA material such as hair so that they can be analysed in a lab and be used in court proceedings of the investigation. One such evidence is Bite Marks.

According to American Board of Forensic Odontology (ABFO), "Bite marks may be outlined as a physica[l] alteration or representative pattern recorded in a medium caused by the contact of the teeth of a human or animal".[2] It is basically a representative of the morphology of teeth of a human/animal on an impression bearing surface such as the human body neck, thighs, breasts, (gluteus region, genitals, face, lips) as seen in sexual assault cases, child abduction, child abuse and homicide cases[3] or can be found on chewing gums, impression materials, stationary items such as pencils, cigarettes and food items such as fruits, cheeses etc.[4] Though there are some limitations, Bite marks are still used as a forensic tool to slim down the inventory of suspects by comparing them to dental casts made of the suspects/offenders teeth impression so that it can be proved that a particular individual or a set of individuals have caused the crime or at least are involved in some part of it.

The review paper describes the classification, characteristics, mechanism, appearance, and collection of bite marks as well as their role in major crimes committed across the globe, along with recent advancement and whether they are universally accepted as clues during criminal trials.

Classification of Bite Marks

They can also be categorised on the premise of appearance (general classification):[5]

1. Artefact-piece of flesh completely bitten off or removed from body.

Corresponding Author: Anandita Kale, BDS Student, K.l.E. V.K. Institute Of Dental Sciences, Kaher Belgaum, Karnataka,

E-mail: kaleanandita96@gmail.com

2. Abrasion-undamaging mark on skin /bruise with no damage to skin
3. Avulsion-removal of skin
4. Contusion-broken blood vessels
5. Hemorrhage-a small bleeding spot
6. Incision-neat puncture of skin
7. Laceration-torn portion of skin

They are also categorised according to pressure (Mc Donald's classification):[6]

- Tooth Pressure Marks- made by incisal edge of anterior teeth; stable and are minimally distorted
- Tongue Pressure Marks-impressions of palatal surfaces or cingulae of teeth and palatal rugae; can cause maximum distortion
- Tooth Scrape Marks-irregularities of teeth caused due to fracture, restorations
- Complex marks- combination of above

They are sorted according to practical application as given by ABFO:[7]

- *Class I*- diffused bite marks; lacks individual characteristics e.g.;-bruise, faint bite mark
- *Class II*- single arch bite or partial bite mark; has some individual and class characteristics
- *Class III*- has both individual and class characteristics; used in evidence and for comparison in criminal cases
- Class IV- avulsion or laceration of tissues caused by bite

Characteristics of Bite Marks

They can be characterized in two forms:

Class Characteristics- According to ABFO[7], a class characteristic is an outline that differentiates a bite mark from other wounds or injuries. They determine what group the bite mark belongs and if it is caused by maxillary teeth or mandibular teeth. A few characteristics are:[8]

- Distance from one cuspid to another
- Shape and thickness of the oral arch
- Proof of a tooth out of position
- Curves of biting surface and the structure of incisal and occlusal edges
- Unique dentistry such as restorations, missing, fractured or malformed teeth
- Wear outlines such as erosion or grinding
- Labiolingual and rotational position
- Rotational position

They help in narrowing down the age, gender and other information of the suspect.

Individual Characteristics- These are distinct identifications present in the class characteristics which can be a trait or a pattern that represents an individual deviation instead of an anticipated finding such as[7]:

- Rotation of teeth
- Mesial or distal shifting of teeth
- Number, size and placement of teeth
- Occlusion
- TMJ abnormalities

Mechanism affecting Bite Marks:

Three mechanisms related with fabrication of bite marks are[9];

Tooth pressure marks

Direct pressure of incisal edges of anterior teeth/ occlusal edges of posterior teeth. Severity of bite mark is related to duration, degree of force applied and degree of movement between tooth and tissue.

Tongue pressure

Material taken into mouth is pressed by tongue against teeth/ palatal ruguae and unique marks are there due to tongue sucking/ thrusting.

Tooth Scrape:

Teeth scraping against tooth surface involving the anterior teeth.

Appearance of Bite Marks:

Human bite marks are semicircular caused by the front teeth (incisors and canines), with a gap at either side due to the separation of upper or lower jaw.[10] The teeth make comprehensible, separate marks or make a continuous or irregularly broken line.

The skin conditions, anatomical spot of the bite, age of the victim and weight are responsible for the distortion made by bite marks. Increased bruising is seen in children, females and geriatric people.[10]

Collection of Evidence

From the victim:

- The photographs which are clicked in high resolution and color balance (to minimize the chances of distortion) and imaged should be of sufficient resolution so that they can be enlarged without distortion.[16]
- Images are presented in front of criminal court justices and investigators as they show the characteristics of the bite marks and the position of the body on which it was recorded.
- Impressions should be taken of the surface which contain 3D imprint of the bite mark. These can be scanned and digitalized by newer computer software[10].
- Trace evidence in the form of DNA is obtained from saliva. Tooth particles can also be used to collect DNA and identify the blood group of the suspect.

From the Suspect:

After obtaining consent from the suspect, their test bites are photographed for legal purposes.

- Photograph should include extroral features (full face, right and left full profiles), intraoral features (taken with mirrors and retractors- anterior, posterior and occlusal view along with shape and size of tongue).[16]
- Examination is done of the hard and soft tissues, TMJ, facial symmetry, occlusal harmony, maximum opening of jaw, jaw deviations while opening and closing of mouth, visible scars, salivary evidence intraoral, number and shape of teeth present, size and shape of tongue, condition of peridontium and any other features that stand out in the oral cavity.[7]
- Impressions of both arches are made using ADA specified material. Duplicate casts are made from original/master cast.

Analysis of Bite Marks

Odontologists should have a comprehensive knowledge of dental and facial structure, interpretation of bite mark patterns and understanding different treatment modalities.[7]

Interpretation of Pattern-

This includes summarizing and comparing class and individual characteristics manually or through computer assisted software to identify any abnormalities or unique dentition that can help identify the culprit.

New advances to help in Bite Mark comparison:

- Overlays (hollow volume, solid volume, semi transparent and/or computer generated-2D/3D scans) and images should be used.[15]
- Test bites of the suspect made on ADA approved dental material, human skin or other mediums using dental casts are used to make over lays.
- Stereomicroscopy and manual or computer generated analysis using software is used.[15]
- Xeroradiography and enhanced contrast radiography is used to understand the depth of the injury.[15]
- Electron microscope investigation is used to analyze surface details of the mark.[15]

Limitations of Bite Marks:

Using Bite marks as forensic evidence is slowly getting abolished as some argue that the precision of a bite mark cannot be maintained due to change in time and temperature and irregularities of the skin. Dentition can change due to diseases, restoration, fractures or any prosthodontic or orthodontic surgical/nonsurgical intervention. The uniqueness of an individual bite mark is assumed but is not recognized.[18]

Specialists claim that out of 32 teeth, only the anterior teeth are recorded in a bite mark and are heavily dependant in the following factors:

Factors that affect bite marks:

-Time at which the bite was inflicted

-Part of the body where the bite was inflicted

-Position of the part of the body that was bitten during the time of the assault

-If the bite was inflicted through clothing. If yes then the clothing is sent for examination for DNA traces through saliva

- If the bite mark and/or injury has been treated with water and medicaments

- If the victim has any pre existing conditions (such as blood disorders) that can alter the morphology of the bite mark

- Factors of location of bite mark such as- adipose deposit. Underlying tissue, area and thickness of skin, any rupture of blood vessels

- Pressure with which the bite was inflicted

- Type of bite inflicted

-The assaulter's oral hygiene and state of occlusion

- Whether the victim was alive when the bite was inflicted. In living beings, healing changes the form of a bite mark over time. Postmortem bites do not show erythema and contusions present in ante mortem marks.

- The temperature at which the bite was inflicted and the change in temperature between its infliction and its record.

-The time delayed after the infliction of the bite mark

The method of bite analysis uses the superimposition of the accuser's dentition to the bite mark so that sufficient comparisons can be taken between the two (taking in considerations of distortion). But this is highly subjective judgment which is dependent on the experience of the examiner and the different methods they choose to evaluate the clues using ABFO guidelines present.

A positive identification of the suspect is usually controversial as it is made without a standard set of conformity and the chance of high distortion at all stages of collection and analysis and falls within the region of opinion evidence.[17]

Bite marks have been used as a forensic tool to solve criminal cases since ages. Some of the cases published in literature have been discussed below;

Case 1-Public prosecutor (Norway) v Torgersen (1958)[11]

Rigmor Johnsen was found dead bearing signs of sexual assault and was considered a murdered. Professor Ferdinand Strom documented a bite mark on her breast and preserved the tissue sample and testified that Torgersen caused it. In 2001, Dr. David Senn re-examined the preserved breast tissue and he saved it with digital and micro photography and after independent and blindsided second opinions, he concluded that Torgersen should be barred as the biter.

Case 2- Crown (Scotland) v Hay(1967)[11]

Linda Peacock (15 years) was found strangled with a bite mark blueprint on her breast. Dr. Warren Harvey questioned 29 suspects out of which five boys were elected for further investigations. Gordon Hay was convicted as the bite mark features matched with the pits present at the tips of his canines.

Case 3-California v Marx (1975)[11]

Lovey Benovsky, found sexually assaulted and strangled with a bite mark on her nose. Three odontologists exhumed her body and took pictures and made a three dimensional model of the bite mark which was used to convict Walter Marx.

Case 4- Florida v Bundy (1979)[11]

One of Ted Bundy's victims had a double bite mark pattern on her gluteus region. Dr. Richard Souviron evaluated the bite marks and testified that Bundy's occlusion aligns perfectly with the picture of the bite mark present on the victim. They pointed out the individual characteristics of bite which were chipped and misaligned teeth and four distinct rows teeth.

Case 5- Florida v Stewart (1979)[11]

Margaret Hazlip was murdered and sexually assaulted with a bite mark pattern on her hip. The bite mark featured a gap between the two upper incisors. The profile of the assaulter was made using a partially eaten bologna found at the crime scene. These were later used to convict Roy Allen Stewart who was executed for his crime.

Case 6 – Wisconsin v Robert Lee Stinson (1986)[11]

Ione Cychosz (63 years) was found dead with bite mark evidence which odontologists evaluated and found several individual patterned injuries which was used to convict Robert Lee Stinson. In 2005, the Innocence Project asked four odontologists to review the case who evaluated DNA evidence which later concluded that it matched another man.

Case 7- New York v Roy Brown (1992)[11]

A social worker was found beaten, stabbed and strangled with 7 bite marks. Roy Brown was accused of the crime but the defense argued that six out of seven were deficient and the seventh barred Brown. DNA results at that time were open to doubt. Additional saliva samples were taken from victim's clothing that exonerated him and was matched to another suspect.

Case 8-Mississipi v Brewer (1992)[11]

Kennedy Brewer was found guilty with the murder of his girlfriend's three year old child. Medical examiner who performed the autopsy that several marks were present on the body which he believed were bite marks and concluded that they were caused by Brewer's top inciors and that the

mandibular teeth made no impression. Dr. Richard Souviron, testified that the marks were not human bitemarks at all but were insect made.

Case 9-Mukesh and another v State (NCT of Delhi) and other / Nirbhaya case (2012)[12]

The Delhi rape case concerned fatal sexual assault. There were six accused arrested with respect to the crime. The forensic odontology dept of SDM Dental College, Dharwad had bite marks taken from the victim and compared with the dental models of the suspect to tie them to the crime.

Case 10- Ayesha Miran Case (2007)[12]

19 year old, Ayesha Miran, was found murdered in Vijaywada. Autopsy revealed sexual assault with stab wounds, scratches and bite marks. DNA samples were pulled from semen traces found in the body.

Case 11-Perumbavoor case (2016)[13]

Rape and murder of a dalit woman had the evidence of two bite marks present on the left shoulder of the victim. The individual trait of the bite mar was a gap of three millimeters present between two teeth in the front rows, which the forensic expert claimed is indigenous to populations in Kerala.

Case 12- Powai Rape Case (2014)[14]

A female forensic odontologist (Dr. Hemalata Pandey) from KEM Hospital helped solve a rape case by matching bite marks present on the survivor's body after she was unable to recollect the details of her rape. Within 24 hours after the case was reported, impression and analysis of the bite marks was done.

Conclusion

Evaluation of a bite mark helps the judiciary to understand the relations between the suspect(s) and the victim(s). Shape, size and the individuality of the mark helps in making a profile of the bite and helps narrowing down the list of suspects by the process of elimination. Although it plays an important role in crime investigations, there is no standard set of rules and conformity to follow and is ambiguous as it is based on subjective judgment and opinion evidence. Slowly but surely, using latest technological advancements and by using DNA traces, this study is becoming less art and more scientific and precise as it expands further in the developing world of forensic odontology.

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Review Article

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Industrial Accidents-Medicolegal Issues Reviewed

VivekanshuVerma[1], Santosh kumar Verma[2]

[1]Associate Consultant, Department in Forensic Medicine and Toxicology, Emergency and Trauma care, Medanta-The Medicity, Gurugram, NCR, [2]Senior Advocate, Department of Law, Rajasthan High Court, Jaipur

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Abstract:

Mapping Industrial Disasters, & relevant laws, based on the past incidences becomes relevant. The goal of the initiative is to prioritize prevention for further in-depth legal investigation & evaluation. We have mapped these to identify their pattern of man-made disaster in the environment, in their region of production, casualty and sickness, and further prevention of such as disaster-associated morbidity & mortality in community, leading to mass casualties, since the time immemorial. The legal know-how of regulations can aid the healthcare providers, in proper medicolegal documentation, in best interests of the victims.

Keywords: Industrial Disaster; Accidents; Sabotage; Arson; Laws, Regulations.

Introduction

Medicolegal investigation has been performed for centuries in all societies, although not always by medical professionals.

Industrial accident means an event resulting from the uncontrolled development in the course of any activity involving hazardous substances either in an installation, for example during the manufacture, use ,storage, handling, or disposal; or during transportation.[1]

The term accident for the purpose of the law relating to compensation for the personal injuries sustained by the workmen & the employer liability in that behalf includes any injury which is not designed by the workmen himself, and it is of no consequence that the injury was designed and intended by the person inflicting the same.[2]

All I's for Easy Recall Identify & investigate an I-Industrial Accident

How to I-#Identify common toxic xenobiotics

How to I-#Investigate a case of Disaster

How to I-#Interpret the findings in scene of accident

How to I-#Interrogate the victim/ accused of accident

How to I-#Initiate the criminal proceeding

How to I-#Intervene the dying victim by first aid as scene of crime

How not to I-#Incite" Nor "I-#Instigate" unnecessarily at scene of accident

Discussion

Mass casualties in industrial accidents can be due to building collapse, fire, chemical burns, electrical sparking, electrocution, explosion, earthquake, leakage of toxic gas, toxic spill.

- Interrogation / Interview Techniques
- Medical Forensics
- Equipment Failure Analysis
- Chemical & Toxic Investigations
- Blast & Explosive Investigations

A good investigator collects evidence, analyzes them, finds the root causes and the relations among

Corresponding Author: Vivekanshu Verma, Associate Consultant, Department of Forensic Medicine and Toxicology, Emergency and Trauma Care, Medanta - The Medicity, Gurugram.

E-mail: vivekanshu@yahoo.co.in

these causes that lead to the accident and provides suggestions about corrective actions to avoid the reoccurrence of the undesired event.

Science of Investigation

- Evolution of Forensic Science
- Principles of Forensic Science in Investigating Industrial Accident
- Theories on Causes of Accidents (with examples & case studies)
- Swiss Cheese, Heinrich and other models
- Root Cause Analysis
- Fishbone Analysis and other tools
- Importance of Reconstruction of Accident
- Recommending Corrective Measures

How to Investigate Industrial Accident

- Evaluate internal and investigation reports, witness statements, documentation and photographs;
- Conduct site inspection and evaluation;
- Collection of physical evidence;
- Examine damaged materials, transferred evidence, conduct chemical analysis to identify chemicals, perform simulation experiments to investigate the reactions and compatibility of chemicals;
- Evaluate industrial processes, work practices, systemic vulnerabilities, and review safety protocols and compliance of practices with best practice;
- Determine the mechanism and function of equipment, as well as the properties of materials; and
- Reconstructing the sequence of events and the possible actions of persons involved in the incident.

How to take History in Industrial Disaster? All K's for easy recall

- K- Kya Hua (Accident/ Arson/ sabotage)
- K- kab Hua (Day, Date, Time of the incidence)
- K- Kaunhai victim (Name, age, gender)
- K- Kahan (place)
- K- Kitne persons(mass Casualty)
- How to take History in Toxic Disaster
- K- Kya khaya (than call Poison control centre)
- K- KitnaKhaya (fatal dose)
- K- KabKhaya (fatal period)
- K- Kesekhaya =ingestion/ inhalation/ injection
- K- Kyunkhaya (Intention-accidental / homicidal/ suicidal reattempt)

The police may book company's Chairman, Director, Plant Manager, Operator and Supervisor) in the FIR under various IPC sections for any industrial disaster:

- 304 (Punishment for culpable homicide not amounting to murder),
- 338 (Causing grievous hurt by act endangering life or personal safety of others),
- 337 (Causing hurt by act endangering life or personal safety of others) and
- 114 (Abettor present when offence is committed).

Medicolegal Reports (MLR) are documents prepared by RMP's government & private doctors, pertaining to injury, sexual offence, suspected poisoning or unexplained death in industrial workers. It contains all the facts, observed by the doctor & his opinion drawn therefrom. Doctor's opinion must be based upon the clinical observations made by him, & not on hearsay evidence.

Examples of Medicolegal Case (MLC) for industrial injuries:-

- Injuries can be physical/chemical/ thermal/ electrical
- Fall from Height
- Crush injury of limbs caught in machine
- Mass food poisoning in eatables.
- Attempted suicide
- Brought Dead
- Alcohol Intoxication
- Chemical injuries, Burns and Scalds
- Venomous Animal Bites- snake, scorpion
- Drowning
- Electrocution

By our nature's gift of 5 senses on scene of accident:

- see (with safe distance),
- touch (texture, feel with safety),
- smell (with precautions),
- taste (not advised, better test it),
- hear the dying declaration, death rattle, sounds in dying victims

Whether act was Accidental or Intentional:

Arson as a crime can be defined as wilful and maliciously setting fire to a property to cause damage.

Section 435 of IPC states that "Whoever commits mischief by fire or any explosive substance intending to cause, or knowing it to be likely that he will thereby cause, damage to any property to the amount of one hundred rupees or upwards".[3]

If the injury or death from the point of view of the workmen who dies or suffers the injury, is unexpected or without design on his part, then the death or injury would be accident although it was brought about by a heart attack or some other cause to be found in the condition of the workmen himself.[4]

Criminal Intentions of the Industrial Accidents:

- False Insurance Claim for unlawful pecuniary gain.
- Destruction of evidence of crimes of fraud, theft or murder to look as accident.
- Pyromania – mental disease of fascination of igniting fire.
- Fire of revenge by an employee with grievance
- Illicit manufacture of illegal material- liquor, narcotics or banned drugs, smuggled goods.

The following acts and rules lay down requirements for emergency preparedness and payment of relief and compensation in India.

- The Factories Act, 1948, amended in 1976 and 1987.
- The Environment (Protection) Act, 1986.
- The Public Liability Insurance Act, 1991, amended in 1992.
- Fatal Accidents Act, 1887
- Workmen Compensation Act, 1923
- Bhopal Gas Leak Disaster (Processing of Claims) Act 1985
- Law of Tort
- Personal Injury law
- Arson Law

Golden Rule of Industrial Disaster Investigations

- Prioritizing your 5 Senses (, , , ,)
- which to use best, and which to utilize least:-
- Use your eyes the most (observe more),
- hands the less (disturb and contaminate to lesser extent) and
- Mouth the least (first analyze the facts then opine,) and
- never disclose to media, always disclose to the legal authority with proper reasoning & scientific logic),
- never taste the toxin to find what it is(as its shown wrongly in our movies & serials) Better get it tested in chemical laboratory (Test, not taste)

Heinrich theory for accident prevention:

The relationship was first proposed in 1931 by Herbert William Heinrich in his Industrial Accident Prevention: A Scientific Approach. Heinrich was a pioneer in the field of workplace health and safety. Heinrich's theory suggested that 88% of all accidents were caused by a human decision to carry out an unsafe act.

Accident causation: Swiss cheese model

The Swiss cheese model of accident causation is a model used in risk analysis and risk management, including aviation safety, engineering, healthcare, emergency service organizations, and as the principle behind layered security, as used in computer security and defense in depth.

It likens human systems to multiple slices of swiss cheese, stacked side by side, in which the risk of a threat becoming a reality is mitigated by the differing layers and types of defenses which are "layered" behind each other.

Therefore, in theory, lapses and weaknesses in one defense do not allow a risk to materialize, since other defenses also exist, to prevent a single point of failure.

It is sometimes called the "cumulative act effect".

In the Swiss cheese model, an organisation's defenses against failure are modeled as a series of barriers, represented as slices of cheese.

The holes in the slices represent weaknesses in individual parts of the system and are continually varying in size and position across the slices.

The system produces failures when a hole in each slice momentarily aligns, permitting "a trajectory of accident opportunity", so that a hazard passes through holes in all of the slices, leading to a failure.

A fire hazard is a situation in which there is a greater than normal risk of harm to people or

property Fire hazards are caused due to materials which catch fire easily and produce toxic fumes when heated or objects which block fire exits, such as blocked cooling vents, or overloaded electric systems and threat hazard to people. Fire due to equipment, LPG, oxy acetylene, oxygen, hydrogen and other inflammable cylinders' explosions. Burst of boilers or containers filled with molten metal. Fire can spread rapidly in insufficiently protected fuel stores or areas with high oxygen concentrations.

Food industry related toxicology

Adulteration with low–cost material, Contamination with infectious bacterial & algal toxins, carcinogenic chemicals for preservation & colouring agents, mass food poisoning: Mid-Day Meals

Mining industry related toxicology:

Occupational Hazards-Asbestosis, Silicosis, Restrictive lung disease, Lung Cancer. Metal fume fever- smelters

Energy industry related toxicology:

Lithium toxicity – Mobile Battery, Lead toxicity-Vehicle batteries, Radioactive metal exposure in thermal power plants- Chernobyl disaster.

The Chernobyl disaster occurred on April 1986 at V.I.Lenin nuclear power plant with four 1000 reactors constructed to a flawed design that was operated by poorly trained personnel.[31] workers died due to radiation poisoning and 30 km evacuation zone created. People were exposed to 1000 times more than the normal radiation. The long term affects resulted in fatal accident.[5]

Manufacturing industry related toxicology:

Toxic Gas exposure- Methyl Isocyanate (MIC) – Bhopal Gas Tragedy in Pesticide manufacturing plants, Water pollution due to toxic chemical release in waste disposal, Cyanide gas in wool processing & plastic manufacture

Highlighted Points in Tyagarajan's Report on Bhopal Gas Tragedy for Legal Responsibility:

- There were cracks in the leaked tank and about 30% more of liquefied MIC than permitted was stored.
- Another tank was found with 35 ton of MIC with similar risk was neutralised deploying helicopter with water jets and area was covered to arrest any leakage of gas or escape for which production plant was started to produce pesticide.
- Clogged pipes were with rusted joints
- It was a disaster of low possibility with high consequence.
- Anderson, the than CEO claimed that it was a sabotage.
- Nitrogen layer was protective layer on top of MIC stored.
- Cooling systems failed.[6]

The tragedy of Bhopal continues to be a warning sign at once ignored and heeded. Bhopal and its aftermath were a warning that the path to industrialization, for developing countries in general and India in particular, is fraught with human, environmental and economic perils.[7]

Michel Wright Investigator From Usa Investigation on Negligence:

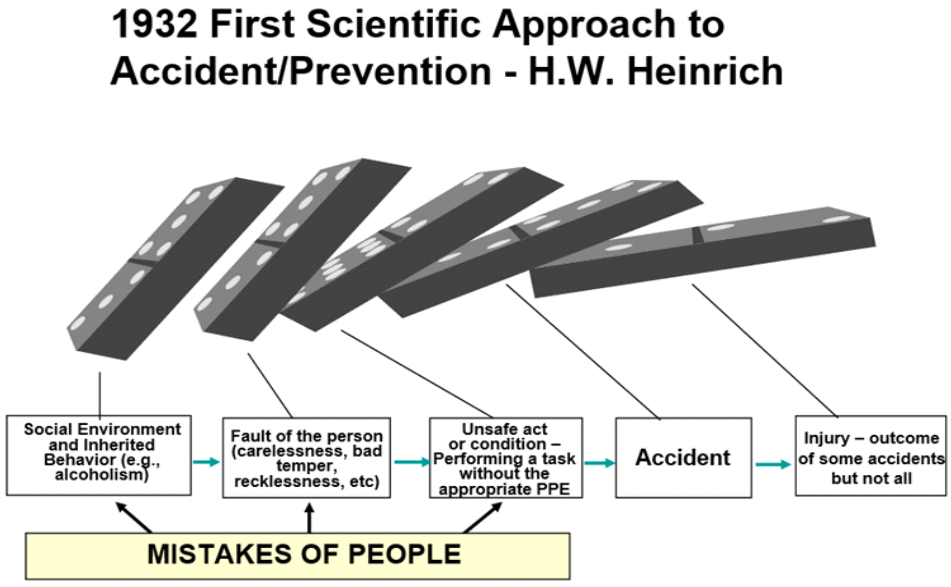
- Vent gas scrubber unit was not sufficient to neutralise Leaked MIC
- Pressure gauzes were faulty
- No refrigeration system was available
- Leakage caused due to cracks in the MIC storage tank
- Water canons to neutralise MIC was not sufficient
- Negligence on part of management was found.
- The plant ought to have been closed well in advance to avert disaster.[8]

The company involved in what became the worst industrial accident in history immediately tried to dissociate itself from legal responsibility. Eventually it reached a settlement with the Indian Government through mediation of that country's Supreme Court and accepted moral responsibility.[9] It paid $470 million in compensation, a relatively small amount of based on significant underestimations of the long-term health consequences of exposure and the number of people exposed.[10] The disaster indicated a need for enforceable international standards for environmental safety, preventative strategies to avoid similar accidents and industrial disaster preparedness.[11, 12,13]

A leak from a styrene tank at a polystyrene plant in Visakhapatnam, India, has killed at least 13 people and injured hundreds. Local reports say between 300 and 400 people have been taken to the hospital with breathing difficulties and a burning sensation in their eyes.[14]

Mapping Atlas of Toxic Disasters around the Globe Indian Society of Toxicology Department of Emergency, Medanta Medicity, Gurugram

North West (Europe)	North (Ukraine-Russia- Siberia)	North East (China, North Korea)
• Jewish German Holocaust- Cyanide Gas • Toxic chemical spill (Switzerland) • Rhine Red, Fish Dead (organophosphate insecticides, mercury compounds & Organochlorines) • Notre Dame Holy water poisoning in Paris • Dioxin- Seveso industrial disaster-Italy • Huelva mines- Metal fume toxicity in Riotinto	• Chernobyl Nuclear Disaster – Ukraine radioactive metal toxicity • Rum Whiskey intoxication • Rasputin Execution failed–Cyanide laced Rum-Cake	• Opium-silk route (Golden Triangle) • Baotou toxic lake: man-made lake of toxic waste • Toxic air tears apart families in Mongolia • A toxic warning to the world: the traditional tents—known as GERS—are warmed by coal-Coal Gas • Jilin chemical plant- Hydrocarbon exposure
West (North America – USA, Mexico, Canada)	**Central (Middle East,Africa-Arabia-UAE)**	**East (South Korea Japan)**
• Battery lead contamination-Industrial Lead toxicity in Los Angeles, California • Greenpoint Oil Spill – Brooklyn, New York • Toxic Potato Salad (Ohio)- Large outbreak of botulismassociated with a church potluck • Bitter Coffee at Church Breakfast-Cyanide Tragedy • United States of Toxins– Utah & Nevada-metal mining- metal fume toxicity • Iatrogenic Opioid Epidemic	• Mad-Honey, bee & wasp stings • Cantharides • Golden Crescent- Opium (Afghanistan-Iran-Pakistan) • Carbon monoxide – Gas Heaters • Apricot- Cyanide1	• Red-tide + Harmful algal bloom in sea coast in summers • Seafood poisoning – Fugu, Ciguatera • Sarin (OPC) Tokyo Subway - Bioterrorism (641 victims)[15] • Fukushima Daiichi nuclear disaster • Cadmium toxicity - Itai-itai disease- "it hurts-it hurts disease" Jinzu river basin-Toyama Prefecture, Japan • Methyl mercury- Minamatadisease • Hiroshima Nagasaki Nuclear Attack & resulting toxicity in Japan • Hydrofluoric acid leak- South Kroea- toxic hydrogen fluoride (HF) gas
South West (South America, Brazil, Peru, West Indies)	**South (Australia, South Africa)**	**South East (Asia –India- Malaysia, Cambodia, Thailand, srilanka)**
• Black widow Spider • Black scorpion • People's temple massacre -Cyanide laced drinks1 • Toxic mud into the Doce River- Heavy Metal Mining: Mariana, Brazil • Goiânia radioactive toxicity due to dismantling a scrapped radiotherapy machine in Brazil • UCLA Laboratory Fire- tert-butyllithium • IHOP Restaurant – Chloramine gas toxicity- kitchen employee -dishwashing machine (South • Charleston, West Virginia)	• Rattle Snake &Coral Snake • Ivory Coast toxic waste dumped of toxic oil sludge • Esperance's lead poisoning disaster • Agent Orange is a herbicide and defoliant chemical, one of the "tactical use" Rainbow Herbicides-Vietnam War- Bioterrorism • Phosphate toxicity mining in Nauru	• Opium (Golden triangle) India-China- Malaysia-Thailand • East India: toxic runoff of Arsenic, Pesticides • Decline of vultures – toxic scavengers - Diclofenac toxicity • Western Ghats- Red scorpion • HOOCH Tragedy- Methanol Country Liquor-Malaysia, India • Methyl IsoCyanate (MIC) Bhopal Gas Tragedy-World's Worst Industrial Disaster • Cyanide Rash- Cassava tubers, Tapioca • Karnataka-Pesticide casualty - Holy Prasad • Carbon monoxide epidemic–Sigdi, Kangri Gas Geysers • Sewer Gas tragedy- Manhole- Hydrogen sulphide



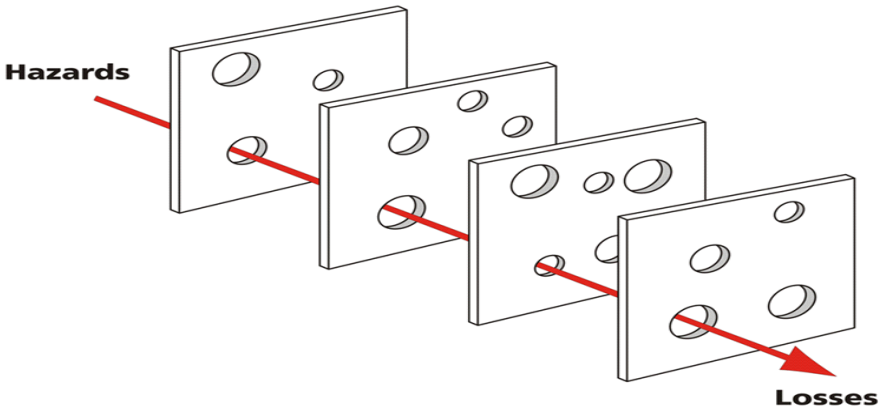
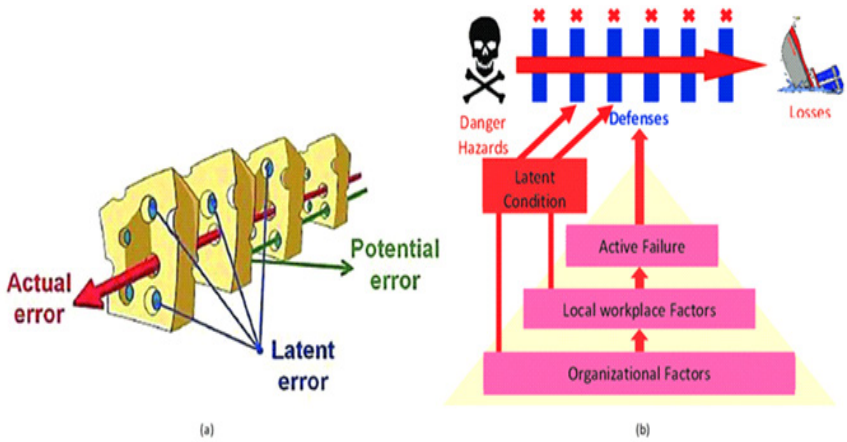
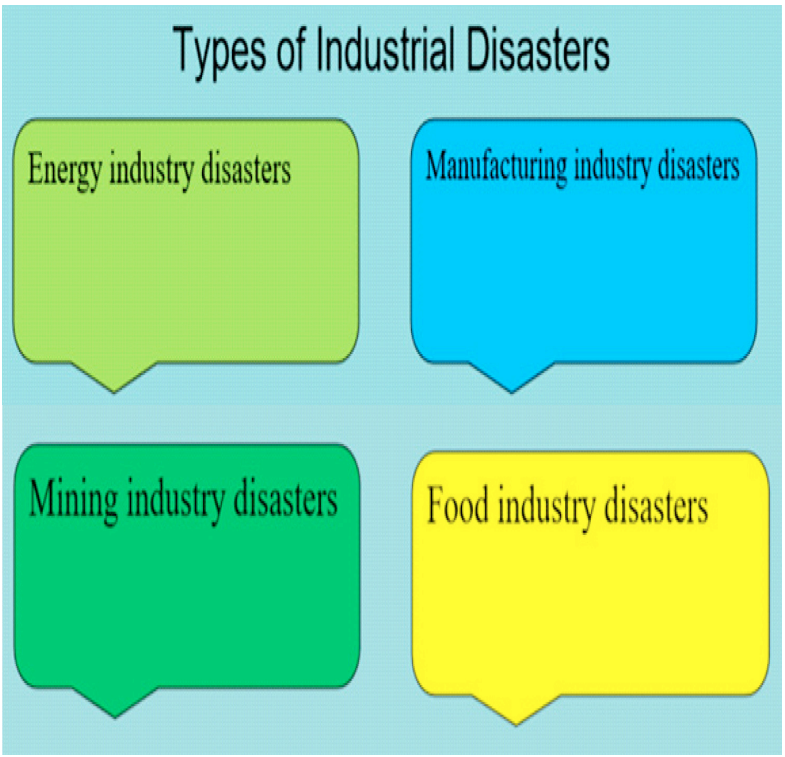
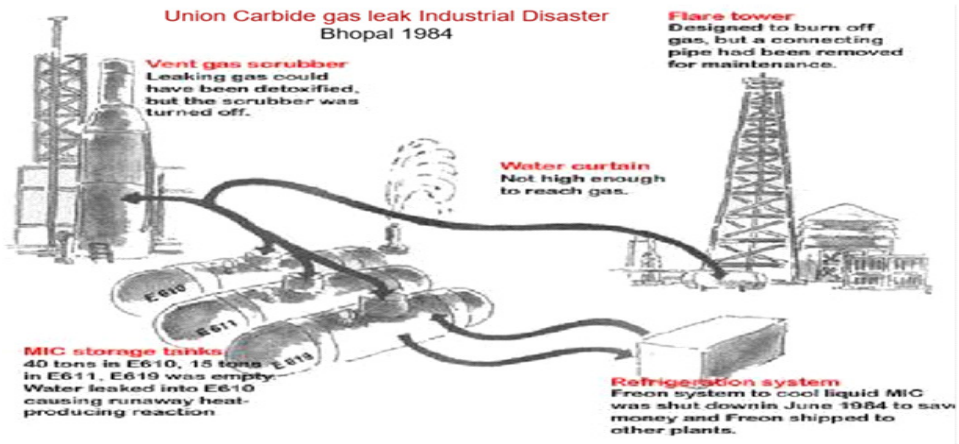


Fig. 1. The Swiss cheese model of accident causation illustrates that, although many layers of defense lie between hazards and accidents, there are flaws in each layer that, if aligned, can allow the accident to occur.







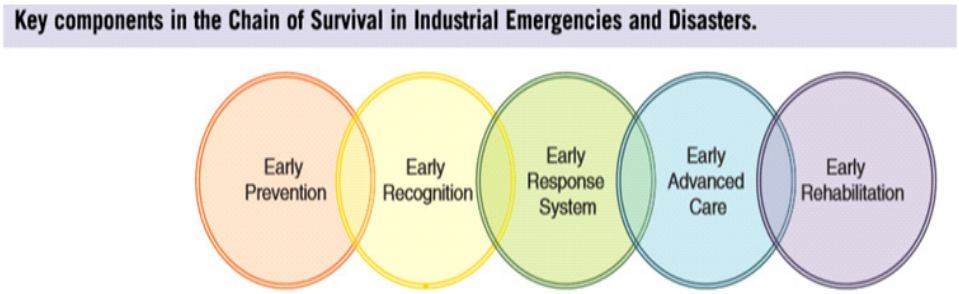


Fig. 2. Chain of Survival in Industrial Emergencies and Industrial Disasters[17]

PPE (*Personal-Protective-Equipment*) for HAZMAT Team handling victims:

HAZMAT- stands for HAZardousMATerial: radiotoxic solids/liquids/Gas

- A-Aprons of Lead
- A-Air Purifying Respirator(APR)
- B- Breathing Apparatus
- B- Booties of Rubber/Leather upto the knees
- B- Biohazard bags with International Biohazard Sign for collecting samples/ disposing the contaminated clothes/ liquids.
- B-Barrier creams - toothpaste applied around eyelids
- C- Caps of plastic for Head
- C-Chemical resistant clothing (overalls and long-sleeved jacket, coveralls, hooded two-piece chemical splash suit, disposable chemical resistant coveralls
- C-Closed-circuit type filters, supplements, and recirculates exhaled gas.
- C-Compressed Air Breathing Apparatus (CABA) or self-contained breathing apparatus (SCBA) is a Positive pressure device worn by HAZMAT rescue workers, firefighters, and others to provide breathable air in an immediately dangerous to life or health atmosphere. SCUBA (Self-Contained Underwater Breathing Apparatus) has cylinder to go inside deep waters.[15]
- D-Decontamination Showers after handling the suspected victim
- D- Dosimeters should be worn at the neck for easy access by the RSO(Radiation safety Officer)
- E- Eye shield & Ear Plugs in noise reduction in industrial safety
- F-Face Shields for splash/ burst of container
- F-Footwear protection (Disposable)
- G- Goggles (Lightweight, Reusable, Indirect Vented (Splash proof), Clear Vision with a Wide Flange and Latex-free) for examining radioactive substances
- G-Gloves of Yellow Rubber
- G-Gown of plastic covering whole body- like astronaut dress
- H-Helmets to safeguard from Head injury in extrication of victims from collapsed vehicles/buildings

- H-Hood mask with Oxygen cylinder, for going inside closed spaces with toxic fumes
- H-High visibility clothing- fluorescent stripes
- I-Isolation

PPE is divided into four categories based on the degree of protection afforded.

1) Level A protection should be worn when the highest level of respiratory, skin, eye and mucous membrane protection is needed.
2) Level B protection should be selected when the highest level of respiratory protection is needed, but a lesser level of skin and eye protection is needed.
3) Level C protection should be selected when the type of airborne substance is known, concentration measured, criteria for using air-purifying respirators met, and skin and eye exposure is unlikely.
4) Level D protection is primarily a work uniform and is used for nuisance contamination only.[16]

Management and Prevention of Industrial Accidents

The Chain of Survival in Industrial Emergencies and Disasters is similar to the cardiac arrest chain of survival of the American Heart Association (AHA) and the trauma chain of survival. It is a sequence of five inter-linked rings, which when practiced, decreases the mortality and morbidity in the concerned population.

The second ring is Early Recognition. Industrial workers and surrounding communities should be equally trained in hazard and risk analysis along with vulnerability assessment.

The third ring is Access to Care by the Early Response System, involving a universal emergency response number and early intervention by on-site trained medical professionals. This ring emphasizes the importance of a link with the surrounding communities, as they are the first responders and the front-line victims.

The fourth ring is Early Advanced Care by EMS for transportation to hospitals or by Emergency Department personnel in referral hospitals.

The fifth and the lastring is Early Rehabilitation,which includes integrated post emergency care,over all rehabilitation and early return to work.

The METHANE reportfor reporting disasters concisely an easy Mnemonic.[17]

- M – Major incident
- E – Exact location
- T – Type of incident
- H – Hazards present and anticipated
- A – Access routes
- N – Number and type of injuries and casualties
- E – Emergency services present and required

The key to successful implementation of Chain of Survival is to have identified components of care, training and quality monitoring. When practiced diligently, this could help prevent industrial disasters, and mitigate their harmful effects on occurrence.[17]

Conclusion

It's popular Myth among professionals that all Industrial accidents are unpredictable, unpreventable and unsalvageable. But the Fact is that some ofIndustrial accidents are avoidable, and preventable. And we can prepare our Emergency Medical Services for better management by stocking the relevant antidotes, thus preventing mortality & morbidity by public awareness of possible casualties nearby those industries. Laws & legal acts discussed, provide concrete regulations for punishing the accused causing negligent acts, resulting in mass casualties

Conflict Of Interest: Nil

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The second page should carry the full title of the manuscript and an abstract (of no more than 150 words for case reports, brief reports and 250 words for original articles). The abstract should be structured and state the Context (Background), Aims, Settings and Design, Methods and Materials, Statistical analysis used, Results and Conclusions. Below the abstract should provide 3 to 10 keywords.

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State the background of the study and purpose of the study and summarize the rationale for the study or observation.

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The methods section should include only information that was available at the time the plan or protocol for the study was written such as study approach, design, type of sample, sample size, sampling technique, setting of the study, description of data collection tools and methods; all information obtained during the conduct of the study belongs in the Results section.

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Discussion

Include summary of key findings (primary outcome measures, secondary outcome measures, results as they relate to a prior hypothesis); Strengths and limitations of the study (study question, study design, data collection, analysis and interpretation); Interpretation and implications in the context of the totality of evidence (is there a systematic review to refer to, if not, could one be reasonably done here and now?, What this study adds to the available evidence, effects on patient care and health policy, possible mechanisms)? Controversies raised by this study; and Future research directions (for this particular research collaboration, underlying mechanisms, clinical research). Do not repeat in detail data or other material given in the Introduction or the Results section.

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Standard journal article

[1] Flink H, Tegelberg Å, Thörn M, Lagerlöf F. Effect of oral iron supplementation on unstimulated salivary flow rate: A randomized, double-blind, placebo-controlled trial. J Oral Pathol Med 2006; 35: 540-7.

[2] Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, *et al.* Caries-preventive effect of fluoride toothpaste: A systematic review. Acta Odontol Scand 2003; 61: 347-55.

Article in supplement or special issue

[3] Fleischer W, Reimer K. Povidone iodine antisepsis. State of the art. Dermatology 1997; 195 Suppl 2: 3-9.

Corporate (collective) author

[4] American Academy of Periodontology. Sonic and ultrasonic scalers in periodontics. J Periodontol 2000; 71: 1792-801.

Unpublished article

[5] Garoushi S, Lassila LV, Tezvergil A, Vallittu PK. Static and fatigue compression test for particulate filler composite resin with fiber-reinforced composite substructure. Dent Mater 2006.

Personal author(s)

[6] Hosmer D, Lemeshow S. Applied logistic regression, 2nd edn. New York: Wiley-Interscience; 2000.

Chapter in book

[7] Nauntofte B, Tenovuo J, Lagerlöf F. Secretion and composition of saliva. In: Fejerskov O,

Kidd EAM, editors. Dental caries: The disease and its clinical management. Oxford: Blackwell Munksgaard; 2003. p. 7-27.

No author given

[8] World Health Organization. Oral health surveys - basic methods, 4th edn. Geneva: World Health Organization; 1997.

Reference from electronic media

[9] National Statistics Online—Trends in suicide by method in England and Wales, 1979-2001. www.statistics.gov.uk/downloads/theme_health/HSQ20.pdf (accessed Jan 24, 2005): 7-18. Only verified references against the original documents should be cited. Authors are responsible for the accuracy and completeness of their references and for correct text citation. The number of reference should be kept limited to 20 in case of major communications and 10 for short communications.

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