

ISSN 2394 - 6822

Volume : 02 Number : 01 Jan - June, 2016 Publication : Half Yearly

# INTERNATIONAL JOURNAL OF ETHICS, TRAUMA & VICTIMOLOGY



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Lamp lighting ceremony by Chief Guest Sh Suresh Jain at TMU, Moradabad



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Delegates and guests at 3rd Conference of Society for Prevention of Injuries & Corporal Punishment at TMU, Moradabad

## INTERNATIONAL JOURNAL OF ETHICS, TRAUMA & VICTIMOLOGY

Journal supported by  
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This journal is published to expand the academic activities and spread the knowledge, ideas and latest research in the field of ethics, trauma and victimology. This journal publishes original research papers, review articles, case reports, letters to the editor and review of books on ethics, trauma and victimology. This journal is supported by Society for Prevention of Injuries and Corporal Punishment (SPIC). This journal is supporting the aims of the Society. This journal also highlights the achievements of the SPIC and its members.

This journal covers the various aspects of ethics, evidence based medical ethics, ethical dilemmas and various dynamic issues related to ethics. It also covers the ethical issues related to Forensic Nursing Science, Forensic Odontology and Forensic Psychiatry. It also covers the ethical aspects of Toxicology including Environmental Pollution. It covers issues related to all sorts of corporal punishment and their prevention particularly in schools. It covers physical as well as psychological aspects of trauma and clinical forensic medicine related to all types of injuries and prevention of injuries. It covers all aspects of Victimology including aetiology, crime scene investigation and prosecution.

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**Issuance:**

Half yearly

**First volume of the journal published in:** 2015

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**Published by:**

Forensicwayout

Dr. R. K. Gorea

#4, Charan Bagh, Patiala 147001 Punjab, India

Phone number: +919872020840

Email: [gorea\\_r@yahoo.com](mailto:gorea_r@yahoo.com)

**Printed at:**

Zenith Design World,

22 No. Phatak, Patiala 147001 Punjab India

Phone number: +919872666799

Email: [zafar.zenith@gmail.com](mailto:zafar.zenith@gmail.com)

**ISSN Numbers:**

ISSN-L: applied for

P- ISSN: 2394 - 6822

e-ISSN: 2395 – 4272

**International Journal of Ethics, trauma & victimology (Online)**

Available online at

<http://ethicstraumavictimology.org>

<http://www.myresearchjournals.com/index.php/IJETV/>

<http://ijetv.forensicwayout.org/>

**Indexed with:****Citefactor at**

<http://www.citefactor.org/journal/index/11666/international-journal-of-ethics-trauma-victimology>

**Ulrichsweb at**

<https://ulrichsweb.serialssolutions.com/search/1467065051>

**Volume of Distribution:**

1000 copies

**Review Process**

It is a peer reviewed journal. Double blind review process is followed.

**Funding Bodies:**

Support by SPIC & donations from philanthropists and advertisements in the journal

**Address for submission of articles:**

Dr. RK Gorea,

College of Medicine

Salman bin Abdulaziz University, PO. Box 173, Alkharj, 11942, Kingdom of Saudi Arabia

**Online submission at**

Email: [editoretv@gmail.com](mailto:editoretv@gmail.com)

**Address request for reprint** or further information relating to any article may please be made with author and in case of multi-author, please communicate with the first author.

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**Subscription Information**

Rs 1200 (Abroad US\$ 120 or Equivalent)/issue)

**Subscription should be addressed to Dr. Rakesh Kumar Gorea, Editor in Chief International Journal of Ethics, Trauma & Victimology payable at PO Box 173, Alkharj, 11942, College of Medicine, Kingdom of Saudi Arabia.**

**Claims for missing issues**

A copy will be sent to member/subscriber provided the claim is made within 2 months of issue of the journal and self-addressed envelope of the size of 9"x12" duly stamped is sent to the editor in chief (those of who want the journal to be dispatched by registered mail should affix Rs. 60 Stamps)

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# IJETV

A Half-Yearly Publication

Volume 2(1), 2016

Department of Forensic Medicine and Toxicology

College of Medicine

Prince Sattam Bin Abdulaziz University

Kingdom of Saudi Arabia

Editor-in-Chief: Prof. Rakesh K Gorea

## *From Editor's Desk*

*In a continuing effort to improve this journal, International Journal of Ethics, Trauma & Victimology is now indexed with ULRICHSWEB and more renowned academicians and experts in the field have joined the editorial and review board of this journal. I convey my thanks to the existing and new members to the office of the editorial and review board of this journal.*

*It is a matter of great for pride for us that authors from the different parts of the globe have patronised this journal. Articles were received from USA, Kingdom of Saudi Arabia, Pakistan, India, Iran, Belgium, Indonesia, and Australia. This time we have received articles in addition to above mentioned country from China. We are continuously seeking suggestions and constructive criticism from our readers and we value their suggestions and criticism for the improvement of this journal.*

*I am thankful to the Middle East Wing of Society for Prevention of Injuries and Corporal Punishment (SPIC) for the help to bring this issue of the journal. I wish the organisers of the 3<sup>rd</sup> Conference of Society for Prevention of Injuries and Corporal Punishment, which is being held at Teeranthkar Mahaveer University, Moradabad on July 30, 2016 a big success and hope this conference will definitely help the objectives and cause of the society.*

**RK Gorea**

## Financial impact of road traffic accidents on the society

Citation: Gorea RK. Financial impact of road traffic accidents on the society. Int J Eth Trauma Victimology 2016; 2(1):6-9.doi. 10.18099/ijetv.v2i1.11129

### Abstract

Road traffic accidents (RTA) are a global problem resulting in deaths, physical injuries, psychological problems and financial losses. These financial damages have immediate consequences and long term consequences on the victims and their families. Different countries have different impact of road traffic accidents and therefore spend dissimilar amounts in their budgets to prevent the road traffic accidents. If the financial losses due to road traffic accidents are calculated and highlighted by the researchers, the respective governments will be willing to spend higher amount in their budgets to prevent such accidents; as governments will be able to directly see the benefits to their countries, of spending higher budget amounts. Various countries are acting differently to reduce this menace of road traffic accidents and World Health Organization (WHO) is celebrating "Decade for road safety" to reduce the accidents and thus the financial losses to the society.

**Keywords:** Road traffic accidents, financial losses, cost, economic loss.

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### Introduction

There are about 1.25 million deaths due to road traffic accidents in the world and 20-50 million cases of non-fatal injuries every year. Pedestrians, cycle users and motorcyclists are more vulnerable to accidents (1). Not only the victims but simultaneously their friends and family members are affected by the consequences of these road traffic accidents. Consequences of RTA, causes financial burden on the victims and their families, friends, employers, insurance companies and the governments. It is very difficult to measure exactly the financial loss for sacrifices and human sufferings (2).

Different countries have different problems and factors responsible for road traffic accidents as depicted by different studies in various parts of the world. Highest rate of deaths due to Road traffic Injuries (RTI) is in the Dominican Republic where there are 41.7 deaths per 100,000 population (3). In a study done in 2013 Nigeria has the 2<sup>nd</sup> highest rate of accidents in a list of 198 countries and recommended that condition of the vehicle, pavements, roads, environment and that of driver should be taken care of to prevent the accidents (4). In UK 65% of the accidents are due to driver error or reaction; injudicious action in 31%; due to inexperience or behavior in 28% and impairment or distraction in 19.6% of cases of fatal road traffic accidents (5). In USA alcohol was responsible for 82% of cases(6).

Financial loss to the victims or compensation can be calculated by different parameters. Financial compensation can be for pain and sufferings from the accident, financial losses of the future in the form of reduction in expectancy of life and future lost income. Past lost income on medical expenses, repair of vehicle, hire vehicle and travel expenses has also to be included for total financial loss. Insurance company outlay and interest on the compensation claim and legal fees are also part of financial losses and may be claimed in a case of motor vehicle accident claim(7). Financial losses due to accidents can be measured by adding costs of emergency services costs, medical costs, legal and court cost, lost productivity, property damages, workplaces loss, insurance administrations costs (6)(8). Wage and productivity loss, motor vehicle damage, employer's uninsured cost, fire loss and motor vehicle duplication costs also adds to the financial losses (8) .

There are some indirect losses due to RTA. Persons suffering from PTSD after accidents had more problems to return to work as compared to persons without PTSD because of their need of financial stability (9). There are also

job losses due to long leaves. Number of persons living with spinal injuries and traumatic brain injuries is increasing due to better medical treatment (10) and cost is increasing for maintaining such persons.

Calculation of financial losses is not easy. There is under reporting and misclassification of injuries and it can be improved by synchronizing hospital records and police records and guidelines should be developed for determining the economic losses. Various quality of life scales should be used; various surveys should be used & mild traumatic brain injuries and their socioeconomic costs should be included. Persons with low socioeconomic status also suffer from more traffic injuries (10).

Calculation of financial losses for RTA can also be done by Disability Adjusted Life Years (DALY) and Gross Domestic Product (GDP) per capita and utilizing this it was estimated that in 2005 there was loss of 167,752.4 million US \$ in the world. Majority of the losses (96%) were in low and middle income countries (11).

There are other ways of calculating these losses by utilizing data of years of life lost (YLL). In a study done in Kashan region of Iran in 2012-2013, 3754 years in males (18.4 per 1000) and 949 years for females (4.8 per 1000) (12) were lost and multiplying by average loss/year financial loss can be calculated.

Cost of treatment varies in different countries and in Brazil where men and young people are mostly involved in road traffic accidents and each hospitalization costs R\$ 1300 on an average (13). In Bangla Desh economic cost of the accidents involve 1-2% of GDP (14). Most of the victims do not have health insurance. In one study done in India in 2015, 74.8% of the victims had to spend more than Rs. 5000 and 73.2% of victims had to spend 10-11 times of their monthly income whereas only 3.5% of victims had health insurance cover(15). In India annual loss is about \$20 billion(16).

In USA each inhabitant has to bear a burden of \$ 784 for accidents equivalent to 1.6% of GDP. If quality of life values are added losses are of the magnitude of \$836 in 2010 in USA (6). In USA seat belt use prevented a loss of \$50 billion and not using it caused a loss of \$10 billion. Distraction of the driver caused a loss of \$40 billion (6).

In European Union there are 1.3 million accidents and 40,000 deaths annually which means 200 billion loss equivalent to 2% of GDP (17) and it has decreased by 45% between 2004 and 2014. In 2014, 25,000 people lost their lives (18).

In 2000 AD financial loss was to the tune of 1% of GDP (19). In 2004 it was estimated 1% of GDP for low income countries, 1.5% for middle income countries and 2% high income countries and global cost is estimated US \$ 18 billion in a year. Out of this low and middle income countries lose 6.5 billion (2). It has increased gradually in 2015 in the low and middle income countries financial losses by deaths and road traffic accidents are to the tune of 5% of GDP where as in the world 3% of GDP is lost in fatal road traffic accidents (20). In a report of WHO it has been reported that 90% of the fatalities are in low and middle income countries though they have half of the numbers of the vehicles in the world (21).

In the last three years 17 different countries have made rules and regulations for enforcing speed limits, seat belts, prevent drunken driving, using of child restraint seat and wearing of helmets by two wheeler users and WHO is trying to reduce the number of these deaths by 50% thus reducing the financial losses in the world due to RTI (22).

To reduce these losses in future, Google suggested autonomous driverless cars will reduce accidents by 90% (23) and thus reduce the burden by 90% due to accidents. Automated system will help to reduce the number of accidents and increase safety (24) and save economical losses.

## **Discussion**

Financial losses are due to injuries, deaths and property damages. To calculate the financial losses for human sufferings will always have ethical dilemmas. But due to increase in compensation cases in the courts all over the world some criteria definitely needs to be evolved to make it objective rather than subjective compensation. There are financial losses occurring in different continents of the world as shown by the various studies but all these

losses do impact their economies to the different extent. This impact is more felt in poor countries as compared to the rich countries (11)(20). Many families suffer due to poverty when their bread earners die or disabled (2). If more money is spent in budgets to take care of the factors responsible for accidents it will definitely reduce the incidence of road traffic accidents this will help in preventing the financial losses. Automated vehicle industry may greatly reduce the number of accidents thus preventing the financial losses to the victims and respective governments(23) but this will take a long time to develop and to be accepted by the people (24). If nothing is done it is estimated that by 2030 road traffic injuries will become the 7<sup>th</sup> leading cause of death and those countries who have made systematic efforts have reduced these losses (21).

### Conclusion

Financial losses due to road traffic accidents are a great burden on the victims, their families, different countries and the world as a whole and especially to the low and middle income countries that bear the major burden due to RTA. These financial losses are preventable by reducing the number of accidents by taking care of the factors responsible for these accidents. Money saved by these measures can be better utilized for developing the new and better roads.

### Conflict of interest

None

**Dr. R K Gorea**  
Editor in chief

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## Media construction of Missing White Woman Syndrome: A cultural complex of innocence

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**Citation:** Stein SL, Carlan PE, Nored LS. Media construction of Missing White Woman Syndrome: A cultural complex of innocence. *Int J Eth Trauma Victimology* 2016; 2(1):10-24. doi:10.18099/ijetv.v2i1.11130

### Article history

Received: September 4, 2015

Received in revised form: June 14, 2016

Accepted: June 20, 2016

Available online: July 20, 2016

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### Abstract

This study assessed whether the media are influenced by the 'cultural complex of innocence' first proposed by psychoanalyst Carl Gustav Jung using content analysis. The cultural complex proposed is that Western society may be culturally conditioned to view blonde-haired (and possibly blue-eyed) Caucasian women as the archetypal image of innocence. In this study it was reviewed 53 missing persons' cases of women across the United States between the years 2000 and 2009. The characteristics of the missing persons analyzed included age, race, hair color, eye color, socioeconomic status, prostitution history, drug history, history of mental illness, etc. Media related to each of the 533 cases was collected from Google News, CNN online, and MSNBC online. The articles were reviewed to determine frequency of keywords relating to the portrayal of the victim used by the three media outlets.

**Keywords:** Missing persons, adult abduction, cultural complex, media, Carl Jung.

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### Introduction

The search for missing persons has gone viral from faces on milk cartons to Facebook groups. Although the Federal Bureau of Investigation (FBI) recorded a reduction in missing persons' cases in the United States for the sixth consecutive year, The Federal Bureau of Investigation (FBI) recorded a reduction in missing persons' cases in the United States consecutively for 6-years at an alarming rate of 661,593 (1). With such inundation of missing, lost, or abducted individuals, media simply do not have the resources to provide sufficient attention to each victim. One noticeable trend in the United States is that attractive Caucasian women typically receive more media attention when reported missing (2),(3). Certain cases -- such as those of Elizabeth Smart, Natalee Holloway, Dru Sjodin, and Brooke Wilberger -- attracted such vast amounts of media attention that the term *missing white woman syndrome* (also known as *missing pretty girl syndrome*) was coined

to explain the phenomenon. One particularly noteworthy characteristic of *missing white woman syndrome* appears to be a subgroup of Caucasian women who receive more (and some would argue better) media attention; namely Caucasian women with blonde hair and blue eyes.

This research has four general assumptions correlated with this sociological syndrome: (1) the syndrome exists to the extent that Caucasian abduction victims receive more media attention than their minority counterparts, (2) the syndrome is primarily attributable to racial disparity, (3) devalued victims (e.g., drug addicts, prostitutes, mental illness) do not receive comparable media attention, and (4) blonde-haired, blue-eyed Caucasian women receive more media attention than other Caucasian women.

From these assumptions, six research questions were there be formed:

1. Do Caucasians represent the majority of abduction victims?
2. Will a higher frequency of abduction for Caucasians with blonde-hair and blue-eyes?
3. Do blonde-haired, blue-eyed Caucasians receive more media attention than other Caucasian and minority victims?
4. Are blonde-haired, blue-eyed Caucasians portrayed in a more innocent and positive manner than other Caucasian and minority victims?
5. Are abduction victims portrayed more negatively by the media when suffering from substance abuse, afflicted with mental illness, engaged in prostitution, marked with distinguishing characteristics (e.g. tattoos), and/or come from low socioeconomic status?
6. Does the location and region of abduction, time of day, and month associated with the abduction affect the media portrayal of the abductee?

Can one singular, physical typology intrigue all Americans? Many believe the blonde-haired, blue-eyed Caucasian woman can indeed accomplish such a feat. From this assertion, researchers reviewed the extant literature to determine when and where this cultural fascination with the fair-haired maiden began. The researchers also aimed to measure the preoccupation today in relation to the media and its' reporting of missing persons.

#### **Missing White Woman Syndrome**

A review of the literature regarding the history of *missing white woman syndrome* in the media revealed In 2002 eight missing person cases were reported in the selected media outlets. These abductions chronologically included Beginning with Rachel Cooke (on January 10) and ending with 27-year old Laci Peterson (on December 24), there were a total of eight high profile cases of Caucasian women covered during the course of one year – the other abductions being those of Danielle Van Dam, Ashley Pond, Miranda Gaddis, Elizabeth Smart, Samantha Reunion, and Cassandra Williamson (2)(Smart & Benson, 2005).

Consider statistics here. Seven of the eight reports or 87.5% of the media reports during 2002 fit the portrait of the fair maiden.

Laci Peterson did not fit the traditional description of a missing Caucasian woman who might receive such media attention; but despite being a brunette of Hispanic origin, she nonetheless received considerable national media. Other high profile cases of missing white women also helped trigger scholarly inquiry into *missing white woman syndrome*. The cases of Elizabeth Smart and Natalee Holloway received extensive amounts of media attention, with Holloway's case representing a particular point of contention among scholars that white women -- particularly those who are Caucasian with blonde-hair and blue-eyes-- receive disproportionate amounts of media attention when compared to victims with other physical attributes (4).

Notwithstanding the aforementioned cases, it should be noted that, in addition as discussed in the 2002 media portal cases, white missing women syndrome appears to illustrate that fair-haired maidens do receive more media attention., An alarming discrepancy also appears to exist regarding the media treatment of Caucasian and non-Caucasian child victims. Between the years 2000 and 2005, 76% of child abduction cases featured on CNN involved Caucasians (3), whereas only 53% of abduction victims were actually Non Caucasian (5). While little scholarly research has addressed the phenomenon of *missing white woman syndrome*, a plethora of commentary from journalists who acknowledge that *missing white woman syndrome* is a critical problem in the media. Moreover, most of these pundits seem to opine that the central issue dividing media coverage of victims is the issue of racial disparity. For example, in 2004, Alex Johnson, a correspondent for MSNBC, suggested that "it helps to be young, white, and female" when one goes missing. To further illustrate his point, Johnson compares two missing persons' cases who were both from South Carolina: Shelton Sanders was an African- American male while Dail Dinwiddie was a Caucasian woman. Dinwiddie's case was covered by media outlets in Michigan, Minnesota, Georgia, Florida, and Wisconsin contingent upon the origin of the tips, whereas Sanders' case was given mediocre media coverage, at best, and only in the immediate vicinity from which he vanished.

In 2005, *Washington Post* op-ed author Eugene Robinson addressed the phenomenon of *missing white woman syndrome*, and named Natalee Holloway, Elizabeth Smart, Chandra Levy, Laci Peterson, Lori Hacking, and Jon Benet Ramsey as victims who captivated the hearts of Americans. Robinson suggested that this phenomenon is caused by inherent racism in America (6). In support of this premise, Sheri Parks of the University of Maryland also discussed in 2006 the Holloway case as an example of *missing white woman syndrome* while appearing on Anderson Cooper 360, and concurred that the issue is attributable to racism.

CNN correspondent Tom Foreman (2006) questioned whether *missing white woman syndrome* was derived from racism, or rather merely a reality of the News business (7). Foreman notes that media often portrays pretty, white, young females to attract the most public attention, and, as a result, these fair white maidens are often viewed as "helpless" (p. 1). Malkin (2005) cites Natalee Holloway as a classic example of *missing white woman syndrome* but raises an interesting point that missing middle- to upper-class women may also receive more media attention because their family members are well-spoken and present themselves in a cohesive manner to television audiences (8).

Another unfortunate dimension of *missing white woman syndrome* is the abduction victims at the other end of the spectrum who receive little to no media attention -- often classified as "devalued victims." In Rule's (2004) comprehensive account regarding victims of the Green River Killer, Rule found the public was far more fascinated and consumed by the phantom killer than with victims who tended to be poor prostitutes (9).

Conversely, a massive task force was assembled to more quickly apprehend notorious serial killer Theodore Robert Bundy, most likely because his primary hunting ground was attractive, middle- to upper-class sorority girls. Gilchrist (2010) studied a similar phenomenon in Canada and found that more than 500 Aboriginal women had disappeared or been murdered since the 1980s, yet press coverage on those women was three and a half times less than for Caucasian women -- who were portrayed more favorably (10). As such, it is reasonable to argue that those Aboriginal women are considered devalued in Canadian society.

Jiwani and Young's (2006) analysis of 128 *Vancouver Sun* articles over a 5-year period 2001-2006 revealed that the devalued missing and murdered women in Vancouver's downtown Eastside involved Aboriginal women and women involved in prostitution much like Rule's 2004 findings; whereas, socially respectable white women were given more press coverage (11).

### **Blondes in the media**

One common media phrase is "sex sells." Indeed, the blonde-haired, blue-eyed, fair-skinned woman has rapidly become sexualized in western media outlets (i.e. movies and advertisements); thus supporting the assertion that these physical characteristics share an interesting dichotomy -- namely that blondes are perceived as both innocent and sexual. Often this very dichotomy of underlying roles, however, which allows for such a diversified market; men view sexual appeal, while women conversely view beauty, innocence, and a desire to emulate these female archetypes of beauty.

Rich and Cash (1993) examined the contextualization of hair color spanning four decades from 1950 to 1980 in an effort to understand the social construction of the blonde metaphor, and the cultural reactions to this depiction of the blonde. Cash and Rich examined 750 images from *Ladies Home Journal*, *Vogue*, and *Playboy*, and discovered that the rate of blondes appearing in magazine ads far exceeded of the number of blondes in the general population. Further, Cash and Rich found the proportion of blondes depicted in magazine advertisements was lowest in the 1960s, and reached its peak during the 1970s. Additionally, Cash and Rich found that *Playboy* magazine featured a significantly higher number of blondes, particularly in centerfolds) than did ladies' magazines (12).

Englis, Solomon, and Ashmore (1994) examined the contents of *Cosmopolitan*, *Glamour*, *Mademoiselle*, *Self*, *Seventeen*, *Vogue*, and *Men's Magazine* to determine the frequency of various physical characteristics in advertisements. The blonde-haired, light-skinned woman fell under the category of classic beauty and is defined by the authors as: "blonde/light hair, WASPish appearance. Although most observers (at least within Euro-American culture) probably associate the notion of classic good looks with blonde hair and Nordic facial features, fashion experts do not currently view Aryan features as a prerequisite for Classic beauty"

(13) (p. 63). Englis, Solomon, and Ashmore found 46 advertisements with the *classic* beauty features, outranked only by the *trendy* category 51 advertisements, which is not unexpected since the goal of fashion magazines is to sell trendy items and concepts.

### **Theoretical rationale**

The work of psychoanalyst Carl Jung and his concept of *cultural complex* hypothesized (14) (Jung, 1959). Jung proposed that a cultural complex is derived from the collective unconscious: an amalgamation of archetypes that psychically bond all members of a society. Archetypes are defined as symbols or images engrained in a cultural identity and recognized by all members of that culture as being symbolic of a particular event or emotion. The collective unconscious then -- this psychic bond between all members of a culture -- has the potential to form what is now referred to as a "cultural complex," defined as the process by which certain objects or individuals are collectively characterized by the symbols associated with them (15).

### **Methodology**

This study employed a combination of qualitative and quantitative methods. Quantitative and qualitative data are not adversarial in nature but rather complementary in that they simultaneously achieve a more in-depth understanding, as well as to construct a sturdier research framework (16).

The objectives of this study were two-fold. The first objective was to discover whether a higher incidence of abduction for Caucasian women with blonde-hair and blue-eyes compared with Caucasian women possessing varying physical features existed. Concurrently the researchers sought to shed light on the rate of minority abductions (e.g. African American, Latina, and Asian); which may provide valuable information to the criminal justice community regarding the prevalence for this type of victim. The second objective was to examine which demographic variables contributed to the frequency of coverage and the portrayal of a victim allocated by the media; and in so doing, provide some insight

into the motivation for the media's fascination with blonde-haired/blue-eyed Caucasian abductees.

The independent variables selected for this study were (1) demographic characteristics obtained from the Charley Project and (2) the content of the coverage within online news sources namely CNN, MSNBC, and Google News. Stepwise regression analysis was used to determine the degree to which a linear combination of those independent variables could explain the variance in the (1) amount of media coverage defined as number of articles written, (2) frequency with which a missing person was portrayed as innocent or positive in the media articles, and (3) frequency with which a missing person was portrayed in a negative manner in the media articles. Next, the data sources and collection will be discussed.

### **Data sources and collection**

The source for the collection of victim data was the Charley Project: a non-profit, on-line list of missing individuals in the United States and internationally. Given there is not a centralized database (to date) of all missing persons in the United States, the Charley Project was considered the most comprehensive source available. All cases (from 2000 to 2009) of abducted females except for family abductions were analyzed. The purpose for this particular timeframe was two-fold: (1) an adequate sample of missing persons was obtained for periods of time both before and after the emergence of the term *missing white woman syndrome* in 2002, and (2) the data had an adequate population size from which to randomly select victims for the qualitative portion of the study.

The independent variables outlined in Figure 1 were selected for several reasons. First, the victim's physical description was imperative to provide the foundation for examining the phenomenon of *missing white woman syndrome* in the context of the proposed cultural complex of innocence. Second, the victim's socioeconomic status was important to collect and whether a victim had tattoos, history of drug use, history of mental illness, and/or history of prostitution to examine the role if any these factors

<b>Victim Information</b>	<b>Abduction Information</b>
Age	Month
Hair Color	Location
Eye Color	Time of Day
Race	Region
Socioeconomic Status (SES)	
Distinguishing Marks	
Drug Use History	
Mental Illness History	
Prostitution History	

**Fig. 1:** Victim and abduction information analyzed from Charley Project

may have in media coverage. Third, elements of the abduction were also important to consider. For example, abductions in foreign, tropical locations, such as Natalee Holloway in Aruba, may have more viewer interest than the case of a child abducted on the way to school.

#### **Qualitative data**

The qualitative portion of this study was a non-traditional content analysis of a disproportionate stratified random sampling of abduction stories within three online news sources -- CNN, MSNBC, and Google News. The original intent was to obtain a random sample of 600 cases divided into 200 blonde-haired, blue-eyed Caucasians, 200 non-blond Caucasian women, and 200 minorities of individuals both over and under the age of eighteen. However, due to an insufficient number of blonde-haired, blue-eyed Caucasian women and blonde-haired Caucasian women in general, coupled with the removal of all abduction victims under 18 years of age, where  $n = 126$  in the Charley Project because of author concerns regarding their disproportionately low percentage of 9.5% when compared to the FBI (2012) statistics regarding the actual number of juvenile missing persons at 75.2% (1). The final sample tallied 533 adult abduction cases spanning four categories including: (1) 112 Caucasian women with both blonde-hair and blue-eyes, (2) 77 Caucasian women with blonde-hair and eye-colors other than blue, (3) 177 non-blond Caucasian women, and (4) 167 non-blond, non-Caucasian women. Abduction victims evaluated in this project ranged from 18 to 95 years of age. The most common victims were between the ages of 18 and 25, which are consistent with national averages (17).

The online sources were selected because the sources were the most visited news networks on the internet (18). Given that not every missing persons case selected for examination in this study received national news coverage, utilization of these particular sites were especially beneficial because the sites often were able to retrieve local news coverage. The most critical element of the study's qualitative portion was assessing the two major ways in which an abduction victim was portrayed by the media: (1) media innocent and positive portrayal and (2) media negative portrayal.

#### **Analysis of data**

Tables 1 and 2 outline the personal and environmental demographic characteristics of the abduction victims within both the Charley Project population and stratified media sample; however, only that which pertains to the stratified media sample is addressed. With regard to personal demographics, the majority of abduction victims in the media sample were Caucasian (68.7%), had blonde (35.5%) or brunette (34.9%) hair, and brown (49.7%) or blue (29.5%) eyes. Moreover, victims tended to have no tattoos (72.9%), not be engaged in prostitution (97.4%), be from lower (46.3%) and middle (50.5%) socioeconomic strata, not be suffering from mental illness (79.5%), and have no history of drug abuse (82.2%).

The most common calendar month demographics were January/February (21.0%) and May/June (20.1%) months during which victims were abducted; whereas the most common locations for the abductions were residences (27.2%), and more specifically, a variety of other indoor locales (42.4%). Table 1 follows.

**Table 1: Personal demographic characteristics of abduction victims**

	Charley Project		Media Sample		Variable
	(N = 1,323)		(n = 533)		
	n	%	n	%	
<b>Race</b>					
Caucasian	777	58.7	366	68.7	
African American	304	23.0	90	16.9	
Hispanic	167	12.6	37	6.9	
Asian	48	3.6	22	4.1	
Native American	14	1.1	9	1.7	
Mixed	13	1.0	9	1.7	
<b>Hair Color</b>					
Blonde	230	17.4	189	35.5	
Brunette	590	44.6	186	34.9	
Red	61	4.6	20	3.8	
Black	386	29.2	122	22.9	
Other	56	4.2	16	3.0	
<b>Eye Color</b>					
Blue	276	20.9	158	29.5	
Brown	811	61.3	266	49.7	
Green	102	7.7	48	9.0	
Hazel	134	10.2	61	11.4	
<b>Distinguishing Characteristics</b>					
No	1,020	77.1	390	72.9	
Yes	303	22.9	143	27.1	
<b>Prostitution</b>					
No	1,296	98.0	519	97.4	
Yes	27	2.0	14	2.6	
<b>SES</b>					
Low Income	608	46.0	247	46.3	
Middle Income	682	51.5	269	50.5	
High Income	18	1.4	17	3.2	
Unknown	15	1.1	0.0	0.0	
<b>Mental Illness</b>					
No	1,087	82.2	424	79.5	
Yes	145	11.0	60	11.3	
Unknown	91	6.9	49	9.2	
<b>Drug Use</b>					
No			438	82.2	
Yes			48	9.0	
Unknown			47	8.8	

Note: Percentages have been rounded to the nearest tenths position.

**Table 2:** Environmental demographic characteristics for abduction victims

Variable	Charley Project (N = 1,323)		(n = 533)	Media Sample	
	n	%		n	%
<b>Month</b>					
January/February	221	16.7	112	21.0	
March/April	209	15.8	86	16.1	
May/June	247	18.7	107	20.1	
July/August	226	17.1	92	17.3	
September/October	217	16.4	75	14.1	
November/December	202	15.3	61	11.4	
<b>Location</b>					
Residence	49	26.4	145	27.2	
Outside Residence	178	13.5	63	11.8	
Parking Lot	163	12.3	68	12.8	
Park / Outdoor	59	4.5	29	5.4	
Other	569	43.0	226	42.4	
Unknown	5	0.4	2	0.4	
<b>Region</b>					
Eastern	49	11.3	54	10.1	
Midwestern	153	11.6	61	11.4	
Southern	605	45.7	252	47.3	
Western	416	31.4	166	31.1	
<b>Time</b>					
Morning	122	9.2	47	8.8	
Afternoon	119	9.0	46	8.6	
Evening	126	9.5	47	8.8	
Night	147	11.1	69	12.9	
Unknown	809	61.1	324	60.8	
<b>Cross-Listed on FBI Site</b>					
No			523	98.1	
Yes			10	1.9	

Note: Percentages have been rounded to the nearest tenths position.

Furthermore, most abduction occurred in Southern (47.3%) and Western (31.1%) states, and usually at times of day unknown to the media (60.8%). Lastly, a very small percentage (1.9%) of abduction cases was housed within the FBI online missing person's website.

With respect to the aforementioned research questions in relation to the Charley Project, a clear majority of abduction victims were Caucasian ( $n = 777$ , or 58.7%); African Americans ( $n = 304$ , or 23.0%) comprised the largest minority group. Moreover, most abduction victims only 112 (8.5%) did not possess blonde-hair and blue-eyes, such cases within the Charley Project population. Lastly, the regression results for particular significant subgroups within the media sample may be limited in their explanatory value given small frequencies for

certain victims: (1) mixed race ( $n = 9$ ), (2) engaged in prostitution ( $n = 14$ ), (3) high socioeconomic status ( $n = 17$ ), and (4) cross-listed on the FBI website ( $n = 10$ ).

#### Analytic Plan

Results for this section were generated from stepwise regression models to explain the variance in media coverage of the three dependent variables of Total Articles, Media Innocent and Positive Portrayal, and Media Negative Portrayal. Researchers considered the relative influences of 13 independent variables from the Charley Project (see Figure 1) and one additional independent variable noting which victims were listed on the FBI website at the time of data collection. Tolerance values for the three stepwise regression models indicated no

issues with multicollinearity among the independent variables.

*Correlation Matrix* (n = 533)

**Table 3:** illustrates the correlations among the three dependent variables selected for stepwise regression. The only strong and significant correlation was between ‘media innocent and positive portrayal’ and ‘total articles’ (r =.671).

Variable	TA	MIPP	MNP
Total Articles (TA)	-----	.671**	.066
Media Innocent/Positive Portrayal (MIPP)	.671**	-----	.114**
Media Negative Portrayal (MNP)	.066	.114**	-----

\*\* p < .01.

Total Articles

Tables 4 and 5 present the stepwise regression results and corresponding descriptive statistics for the dependent variable ‘total articles.’ The most significant variable in this model ( $\beta = .30$ ) accounted for 10.7% or roughly 85% of the total variance of 12.5%, indicating that a missing persons case featured on the FBI’s website would generate, on average, 20 more articles (b = 20.36). Time of abduction ( $\beta = .11$ ) accounted for 1.1% of the total

variance and demonstrated that the number of articles associated with each victim increased (b = 0.94) by nearly one when abducted during the evening hours instead of morning/afternoon and nearly two articles when the abduction occurred in the nighttime hours.

Month of abduction ( $\beta = .09$ ) accounted for a mere fraction 0.7% of the total variance, and indicated that victims abducted during the months of January and February receive approximately two more articles (b = 1.94) than victims abducted during other months.

**Table 4:** Total articles stepwise regression model

Significant Predictors	Rank	R <sup>2</sup>	b	SE b	$\beta$	t
Cross-Listed on FBI Site	1	.107	20.36	2.81	.30	7.26
Time Abduction	2	.118	0.94	0.35	.11	2.66
Month Abduction	3	.125	1.94	0.93	.09	2.09
Constant			-0.21	0.50		-0.42

Note: n = 533, SE = 8.62, F = 25.19, R = .35, R<sup>2</sup> = .13, Adj R<sup>2</sup> = .12, p = .000

Coding Legend: Cross-Listed on FBI Site (Yes = 1, No = 0); Time Abduction (Night = 3, Evening = 2, Morning/Afternoon = 1, Unknown = 0); Month Abduction (January / February = 1, Other = 0)

**Table 5:** Means comparison – total articles

Significant Predictors	N	Mean	SD
Cross-Listed on FBI Site			
Yes	10	23.00	56.66
No	523	0.86	4.64
Time Abduction			
Night	69	4.12	22.04
Evening	47	3.23	14.95
Morning/Afternoon	92	1.28	2.09
Unknown	324	0.38	0.88
Month Abduction			
January/February	112	3.45	19.82
Other	421	0.70	1.25

Note: Means and standard deviations have been rounded to the nearest hundredths position.  
Media Innocent and Positive Portrayal

Tables 6 and 7 present the stepwise regression results and corresponding descriptive statistics for the dependent variable 'media innocent and positive portrayal.' The most significant variable in this model ( $\beta = .46$ ) accounted for almost three fourths or 24.7% of 34.0% of the total variance in the dependent variable and indicated that a missing persons case featured on the FBI website would generate approximately 10 more innocent or positive terms per article ( $b = 10.54$ ). The second most important variable in the model ( $\beta = .19$ ) captured an additional 4.6% of the total variance and indicated that blonde victims receive slightly in excess of one additional innocent or positive portrayal per article ( $b = 1.25$ ) when compared with women with other hair colors.

Time of abduction ( $\beta = .13$ ) represented only 2.7% of the total variance and essentially indicated that the number of innocent or positive portrayals increased ( $b = 0.36$ ) proportionately as the abduction time transitioned from morning/afternoon into the evening and nighttime hours. The next most significant variable in this model ( $\beta = .10$ )

represented 1.2% of the total variance and indicated that being abducted in the Eastern portion of the United States generated about one half ( $b = 0.47$ ) more innocent or positive portrayal than those abducted in the Southern region, and nearly one additional innocent or positive portrayal than those abducted in the Midwestern or Western states.

Location of abduction ( $\beta = .10$ ) also had a significant effect on how many times victims were referred to as innocent or positive and indicated that those abducted from parks and other outdoor areas received slightly more portrayal as innocent or positive ( $b = .22$ ) than those abducted from a residence and progressively more such innocent or positive portrayals when compared with those abducted from a parking lot, outside a residence, and a variety of other indoor locales.

This model supports the premise that victims of abduction with blonde hair received significantly more positive or innocent terms per article than victims with varying hair colors.

**Table 6: Media innocent and positive portrayal stepwise regression model**

Significant Predictors	Rank	R <sup>2</sup>	b	SE b	$\beta$	t
Cross-Listed on FBI Site	1	.247	10.54	0.82	.46	12.84
Hair Color	2	.293	1.25	0.23	.19	5.34
Time Abduction	3	.320	0.36	0.11	.13	3.20
Region Abduction	4	.332	0.47	0.17	.10	2.73
Location Abduction	5	.340	0.22	0.09	.10	2.58
Constant			- 0.92	0.32		- 2.84

Note:  $n = 533$ ,  $SE = 2.53$ ,  $F = 54.31$ ,  $R = .58$ ,  $R^2 = .34$ ,  $Adj R^2 = .33$ ,  $p = .000$

Coding Legend: Cross-Listed on FBI Site (Yes = 1, 0 = No); Hair Color (Blonde = 1, Other = 0); Time Abduction (Night = 3, Evening = 2, Morning/Afternoon = 1, Unknown = 0); Region Abduction (Eastern = 2, Southern = 1, Midwestern/Western = 0); Location Abduction (Park/outdoor = 4, Residence = 3, Parking Lot = 2, Outside Residence = 1, Other/Unknown = 0)

illness if such status was unknown received approximately one half additional negative term per article ( $b = .43$ ) than victims not suffering from mental illness.

Race ( $\beta = .15$ ) accounted for 3.1% of the total variance and indicated that mixed race abduction victims received the greatest amount of negative terms. The regression model specifically estimated that mixed race victims received one quarter more negative terms per article ( $b = .26$ ) than Caucasian abduction victims and just more than one half more negative terms than that generated for other non-Caucasian abduction victims.

Tables 8 and 9 below present the stepwise regression results and corresponding descriptive statistics for the dependent variable 'media negative portrayal.' Mental illness ( $\beta = .21$ ) accounted for 4% or approximately one quarter of the total variance of 14% and indicated that victims suffering from mental

To a lesser degree and more generically depicted, the regression results also showed in order of contribution that (1) being abducted in December

and February, (2) engaging in prostitution, (3) being part of the upper class socioeconomic spectrum, (4) being more youthful, and (5) being abducted in the

Eastern and Western states as opposed to Southern and Midwestern states all produced more negative terms per article.

**Table 7:** Means comparison – media innocent and positive portrayal

Significant Predictors	N	Mean	SD
Cross-Listed on FBI Site			
Yes	10	12.20	13.48
No	523	0.85	2.06
Hair Color			
Blonde	189	2.03	4.71
Other	344	0.57	1.53
Time Abduction			
Night	69	2.48	5.89
Evening	48	2.10	3.96
Morning/Afternoon	92	1.72	3.31
Unknown	324	0.43	1.42
Region Abduction			
Eastern	54	2.56	4.40
Southern	252	1.00	3.54
Midwestern/Western	227	0.70	1.86
Location Abduction			
Park/Outdoor	29	1.90	2.79
Residence	145	1.89	4.84
Parking Lot	69	1.35	2.56
Outside Residence	62	1.00	2.69
Other/ Unknown	228	0.37	1.32

Note: Means and standard deviations have been rounded to the nearest hundredths position.

**Table 8:** Media negative portrayal stepwise regression model

Significant Predictors	Rank	R <sup>2</sup>	b	SE b	β	t
Mental Illness	1	.040	0.43	0.89	.21	5.10
Race	2	.071	0.26	0.07	.15	3.61
Month Abduction	3	.089	0.23	0.07	.13	3.31
Prostitution	4	.108	0.68	0.22	.13	3.14
SES	5	.123	0.72	0.24	.12	2.97
Age	6	.132	- 0.01	0.00	- .11	-2.58
Region Abduction	7	.140	0.09	0.04	.09	2.18
Constant			- 0.05	0.12		-.373

Note: n = 533, SE = .79, F = 12.22, R = .37, R<sup>2</sup> = .14, Adj R<sup>2</sup> = .12, p = .000

Coding Legend: Mental Illness (Yes/Unknown = 1, No = 0); Race (Mixed = 2, Caucasian = 1, Other = 0); Month Abduction (December = 2, February = 1, Other = 0); Prostitution (Yes = 1, No = 0);

SES (Upper Class = 1, Other = 0); Age (in actual years); Region Abduction (Eastern = 3, Western = 2, Southern = 1, Midwestern = 0)

**Table 9:** Means comparison – media negative portrayal

Significant Predictors	N	Mean	SD
<b>Mental Illness</b>			
Yes/Unknown	108	0.56	1.29
No	425	0.14	0.67
<b>Race</b>			
Mixed	8	1.38	2.77
Caucasian	367	0.28	0.91
Other	158	0.04	0.25
<b>Month Abduction</b>			
December	25	0.64	1.58
February	51	0.45	1.22
Other	457	0.17	0.72
<b>Prostitution</b>			
Yes	14	0.93	2.02
No	519	0.20	0.79
<b>SES</b>			
Upper Class	11	1.09	2.43
Other	522	0.20	0.78
<b>Region Abduction</b>			
Eastern	54	0.37	1.12
Western	165	0.31	1.08
Southern	253	0.16	0.67
Midwestern	61	0.10	0.35

Note: Means and standard deviations have been rounded to the nearest hundredths position.

### Discussion

The findings of this study provide support for the existence of a cultural complex of innocence. Blonde abduction victims were portrayed by the media as more “positive” or “innocent” than other Caucasian and minority women. Conversely, mixed race victims were viewed more negatively than victims of other races. Other notable results included the appearance of time, region, location, and month of abduction across the three models.

From the initial Charley Project population (n = 1,323) of missing persons (2000–2009), Research question 1) supported that Caucasians or 58.7% were abducted more frequently than all other minorities combined or 41.3%. Although cases listed on the Charley Project do not purport to be representative of the entire population of missing persons in the United States. Census data indicate that the Caucasian majority was reasonably consistent though a bit underrepresented with the racial distribution of the general population (Caucasian abductees represented 75.1% while Black abductees represented only 12.3%; but equally demonstrates that the Black abduction victims

nearly double their percentage within the general population (19).

Research Question 2 proposed there would be a higher incidence of abduction for blonde-haired, blue-eyed victims across the United States; however, this research question was not supported by the research. A – possibility for the possible negative finding was that a consequence of predators being influenced by the cultural complex of innocence; however, this thought was not supported, and only a small portion 17.4% of abduction victims were blonde-haired women and an even smaller number 8.5% possessed both blonde-hair and blue-eyes. Brunette victims were by far the most common 44.6%; however, brunettes – quite unlike blondes transcend racial groups.

Research Question 3 that sought to determine if hair color was a significant factor in media reports was not support. The number of articles generated for Caucasian blondes were roughly doubles that of their non-blonde minority and Caucasian counterparts. Subsequent regression analysis; however, indicated that the large disparity could not

be attributed to the variations in victim hair color. As such, one cannot conclude that hair color has a great bearing on the reason for the larger number of articles written about Caucasian women, but blonde haired women do receive more media attention.

Research question 4 asked whether or not Caucasian abduction victims with blonde hair were described significantly more often as innocent or positive was supported in this research. Caucasian blondes represented an average of more than one term per article, followed though not closely by brunettes, redheads, and victims with black hair.

Race was not a significant predictor of how often a victim would be described in a positive or innocent manner. This finding supported the general hypothesis of a cultural complex of innocence because racial disparity did not appear to be the only contributing factor to the sociological phenomenon of missing white woman syndrome.

While race was not a significant predictor of whether a victim would be described in a more positive or innocent light by the media, race was a significant predictor for whether victims would be portrayed negatively. Data revealed that mixed race victims were most likely to be portrayed negatively, followed by Caucasian victims, and subsequently victims of other races. While noteworthy, the finding nonetheless is not generalizable given that mixed race victims represented such a small portion of the media sample ( $n = 9$ ), or 1.7%.

While not a formal research question, a case cross-listed on the FBI's website was discovered to be a significant predictor for the amount of total articles related to a case. Also on an average, such a cross-listing generated approximately a 23-to-1 ratio of articles compared to victims who were not cross-listed on the site. Again, though, as with mixed race victims, these discrepancies – though startling -- are not generalizable given their small number of cases within the media sample ( $n = 10$ ) or 1.8%.

The authors also investigated in research question 5 whether certain personal demographic variables would contribute to negative media portrayals and found support for this hypothesis. Victims not reported to be afflicted with a mental disorder and victims engaged in prostitution at the time of their disappearance, received approximately one half and three quarter more negative terms per article

respectively. The socioeconomic results were somewhat surprising, in that upper-class victims received nearly four times the number of negative terms per article than the amount allocated to lower- and middle-class victims. Lastly, the findings indicated that fewer negative terms per article were utilized as the abduction victim becomes older. The findings did not; however, reveal any significant indication that possessing distinguished marks on the body, such as tattoos influenced their manner of media portrayal.

Research question 6 covered whether the region, location, time and month of abduction would affect the nature of victim portrayal by the media. This hypothesis was supported by the research. Both the time and month of a victim's abduction were significant predictors regarding how much media attention as calculated by the total articles the case would generate. On average, victims would receive nearly two more news articles when abducted in January or February. A similar amount of coverage as the time of day progressed from morning and afternoon into the nighttime hours. Media Innocent and Positive Portrayal, showed that time, region, and location of abduction were significant predictors. Victims would receive one extra innocent or positive reference per article as the day progressed from morning and afternoon and into the nighttime hours. Moreover, victims abducted from the Eastern region of the United States would receive the greatest number of innocent or positive terms per article representing nearly one half more per article than for abductions in Southern states, and progressively less when abducted from Midwestern and Western states. Victims also were more often described as innocent or positive when taken from a park or other outdoor area.

One reasonable inference from such a finding was that victims actually are more innocent because the likelihood of victims voluntarily disappearing under such circumstances is highly improbable. Conversely, month and region of abduction were shown to be significant predictors of whether a victim would be negatively portrayed by the media. Being reported missing in December or February added upward of one half additional negative terms per article, whereas disappearing from the Eastern region of the United States similarly enhanced the likelihood of receiving more negative terms per article.

This research sought to examine whether the primary contributing factor to the phenomenon of *missing white woman syndrome* was indeed racial disparity, or rather the result of other contributing factors. The findings somewhat support the notion that racial disparity contributed to the concept of *missing white woman syndrome*; that is, minority victims with black and brown hair were found to receive different treatment than Caucasian victims with the same hair color and Caucasians with blonde hair. These victims received less media attention in general, were less likely to be portrayed in a positive or innocent manner, and often times received less attention from law enforcement as reflected in media accounts.

The frequency of race within major news network report about abduction victims also is interesting. The vast majority of articles used for this study were derived from Google News. Surprisingly, CNN and MSNBC featured very few missing persons' cases that also were in the Charley Project population. However, when abduction victims were featured on CNN and MSNBC sites, the disparity in the amount of coverage for Caucasian and minority cases was somewhat disturbing.

On CNN, seven cases within the media sample were featured: Kelsey Collins, Renee Pernice and Leah Roberts once each Kyla Porter and Lisa Stebic twice each, Maura Murray 4 times, and Jennifer Kesse 8 times. While coverage of one Black victim, Kelsey Collins, in a group of seven victims or 14.3% was quite consistent with the proportion of Blacks or 12.3% within the U.S. general population, the number of actual articles written about the victims was far from equitable, as only one single article or 5.3% of the 19 total articles was devoted to the Black victim

MSNBC featured four cases: Kimberly Whitton once, Cheryl Pearson and Lisa Stebic twice each, and Jennifer Kesse 4 times. Again, with the exception of Pearson a successful pediatrician, all victims were Caucasian women. There does appear, then, to be some degree of racial disparity reflected in trends, which emerge from an examination of CNN and MSNBC two news sources.

### **The cultural complex**

It is the phenomenon of *missing white woman syndrome* wholly attributable to racial disparity; or rather has western culture in the United States

become subconsciously conditioned to viewing the blonde-haired, blue-eyed Caucasian woman as an archetypal symbol of innocence – a conditioning process which appears to be a result of cultural overexposure to various media platforms which consistently feature these physical characteristics as innocent, beautiful, and frail.

The two regression models used in this research statistically demonstrated that hair color was a significant predictor of how abduction victims are portrayed. Specifically, blonde Caucasian women were more likely to be portrayed in an innocent or positive manner by the media. Perhaps there were elements of racial disparity related to the sociological phenomenon of *missing white woman syndrome*; there was an even more significant factor at play: the collective unconscious. These results illustrated that the disparity in both the amount and quality of media coverage devoted to blonde Caucasians and minorities differed little from the disparity between those same blonde Caucasians and other Caucasians. This finding has significant implications because it supported the hypothesized cultural complex of innocence as defined by Jung (20) which explains the process by which certain objects or individuals are defined collectively by the symbols associated with them (15). This research has shown that the blonde-haired Caucasian woman, to some degree, has evolved over the centuries in Western culture as synonymous with innocence.

### **Limitations and future research**

The authors identified four potential limitations of the current study. One limitation was not fully exploring the social construction of the concept of *missing white woman syndrome* because reader comments had to be excluded from analysis. Another limitation was the research still merely scratched the surface of what a comprehensive sample of missing persons' cases would entail, although the number of cases in this study provided ample opportunity for evaluation. A third limitation was the juvenile population under 18 years of age was removed from the analysis. The final limitation was the sizes of the varying racial groups were not well distributed, while there were 200 minority cases included in the media sample.

The researcher, however, believed that they should distinctly consider each racial subset to determine if there were significant differences between or among minority groups. Nonetheless, this limitation

precludes completely generalizing the results to the greater population. As a whole, though, the authors believe these limitations were not a significant hindrance to the validity of the research findings.

There are several possibilities for future research. First, replication of this study with a larger sample is encouraged. Second, equal group sizes of Caucasians and minorities would allow for more direct comparisons. Three, researchers should replicate the study with both a juvenile and adult population to determine if there any differences between the groups in reference to media coverage and quality of portrayal. Four, literature suggests that 'motherhood' seems to be a critical factor in portraying the victim in an innocent or positive light; and as such, future researchers may want to explore the differences in media coverage between groups of women who do and do not have children.

Moreover, this study exclusively examined women; future researchers should consider gathering a sample of male abduction victims for comparison purposes. Lastly, is the researchers recommend that a survey of both media professionals to examine which factors may influence the promulgation of *missing white woman syndrome* and law enforcement officials to examine what, if any, bias exists in the midst of such investigations would be a wise investment.

### Conclusion

The problem of abduction is pervasive in American culture. Nearly 700,000 individuals are reported missing annually in the United States (1). This inquiry into the etiology and promulgation of *missing white woman syndrome* was a preliminary attempt to shed light on which victims receive the most media attention, and what factors lead the media to believe even if subconsciously that some victims of abduction are more deserving of attention than others. No family asks for their daughter to be torn from their arms, and no victim of abduction asks for their life to be stolen. In that sense, all victims are innocent.

### Conflict of interest

None declared

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## Age estimation in children using Demirjian's technique: A retrospective study

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**Citation:** Kende PP, Khadilkar AS, Gaikwad RP, Landage JS. Age estimation in children using Demirjian's technique: A retrospective study. *Int J Eth Trauma Victimology* 2016; 2(1):25-29. Doi: 10.18099/ijetv.v2i1.11131

### Article history

Received: September 25, 2015

Received in revised form: December 21, 2015

Accepted: February 25, 2016

Available online: July 25, 2016

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### Abstract

Age estimation is a sub discipline of forensic odontology which plays an important part in every identification process, especially when information related to the deceased is unavailable. The aim of this study was to evaluate the accuracy of Demirjian's Dental Age Estimation technique, with the help of Ortho-Pantomo-Graphs (OPG) in 50 children.

50 OPGs of children in the age group of 6-16 years were randomly selected and a cross-sectional retrospective study was conducted. Age estimation was done by the method given by Demirjian and two tailed test of the data was carried out.

A significantly high difference was observed in the estimated and chronologic ages in the age group of 13-16 years than in 6-12 years.

Demirjian's original method, using seven mandibular teeth is an accurate method of age estimation in children especially of the younger age group (6-12 years of age).

**Key words:** age estimation, younger age group, Demirjian's technique.

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### Introduction

Age estimation in children is an important part of forensic science for situations such as criminal responsibility, rape, paternity in question, alleged date of conception, kidnapping, and punishments for juveniles, for children of unknown birth data such as adopted children or unidentified skeletons of children, and child employment.

Teeth are one of the key systems in the body, and their degree of development is used as one of the indices of biological age. Development of human dentition follows a reliable and predictable developmental sequence up to the second decade of life (1). Variations in tooth development are very small and thus dental estimation of chronological age is an important method of age

determination especially for children. Compared to bone mineralization, tooth mineralization is much less affected by variation in endocrine and nutritional status, and tooth development thus provides a better estimation of chronologic age, although the above factors cannot be completely ignored (2). This article highlights the technique per se and the advantages and disadvantages of this technique in forensic odontology.

### Aims and Objectives

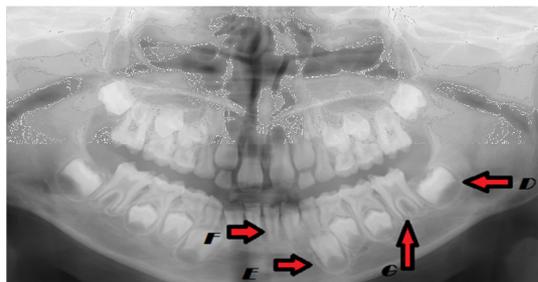
Demirjian's method is a very popular and time-tested method for age estimation, especially in children, hence a study was conducted: (1) to study the accuracy of Demirjian's method of age estimation in children who reported to

Government Dental College & Hospital, Mumbai, (2) to study the variation in accuracy of the method in males and females, and (3) to study the applicability criterion for applying Demirjian's method in forensic science.

**Materials & Methods**

A cross-sectional retrospective study was conducted on 50 OPGs, randomly selected from the archives of the Department of Oral Medicine and Radiology, Government Dental College & Hospital, Mumbai.

The inclusion criteria was: age group between 3-16 years, healthy children; who were free from any disorder affecting growth; good radiographic quality; the presence of all seven left or right mandibular permanent teeth (erupted or un erupted). The exclusion criteria was age of patient >16 years of age, developmental deformities causing defects in the area of interest, unclear OPGs, bilaterally missing corresponding mandibular teeth (except third molars).



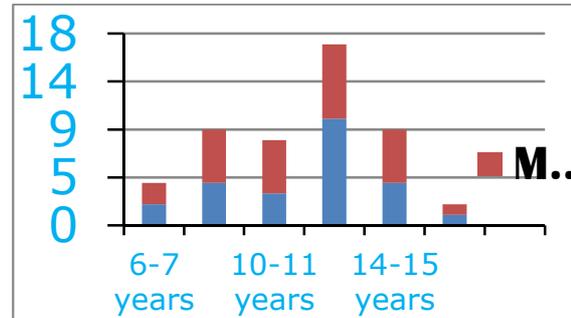
**Fig. 1:** Arrows showing tooth development stage

Dental age estimation was performed according to Demirjian's method as described in literature (3). The observer was blinded as regards the chronological age of the sample units. Stages of tooth development were compared on the OPG (Fig. 1) to the diagrams given by Demirjian (Fig. 2). Maturity scores were given according to developmental stages (A-H) of each of the seven left permanent teeth of the mandible (different for males and females) and were tabulated (Figs. 3 and 4). These scores were then summed up to obtain an overall maturity score. This total score was then converted into dental age using published conversion tables (Figs. 5 and 6)(2).

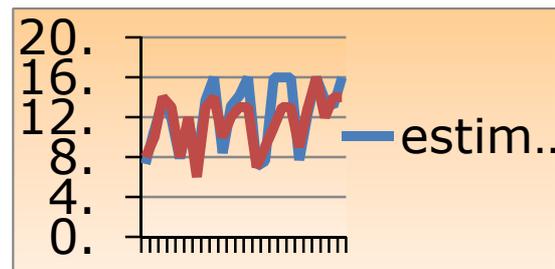
**Results**

Age-wise distribution of the sample is depicted in Graph 1. Comparative analysis of males and females, revealed similar correlation coefficients (females-0.873111 and males-0.890906). No

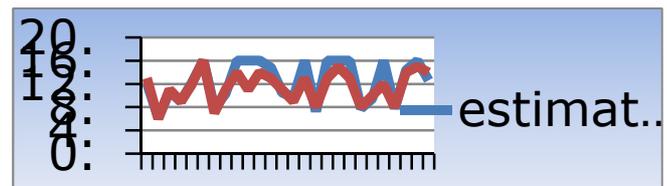
significant difference was found in the accuracy of the method for boys and girls (Graphs 2 and 3). The correlation of the estimated age and chronologic age is depicted in Graph 4. The overall correlation coefficient is high (=0.882368). A significantly high difference is observed in the accuracy of the method when all the teeth have reached the H stage, regardless of the age and sex (Table 1).



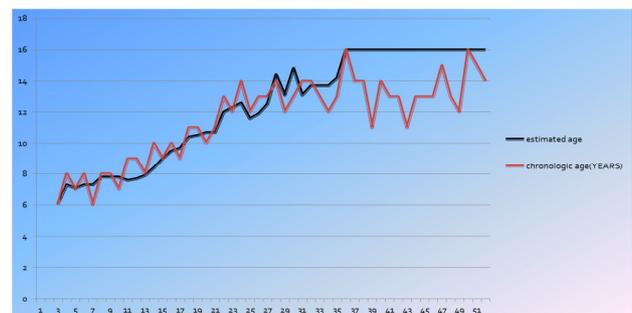
**Graph 1:** Age wise distribution of the sample



**Graph 2:** Correlation coefficient for males



**Graph 3:** Correlation coefficient for males



**Graph 4:** Correlation of estimated age and chronological age of entire sample

**Table 1:** A significantly high difference is observed in the accuracy of the method when all the teeth have reached the H stage, regardless of the age &sex

Sample	Correlation Coefficient	Bias	Inaccuracy	Standard deviation	Standard Error of Means (SEM)
Entire Sample	0.882368	-0.014	0.014	1.223893	
At least one tooth in <H stage	0.939332	-0.0061	0.0061	0.484358	0.08425
All 7 teeth in H stage	0.087594			1.462773	0.35459

(The two-tailed P value is less than 0.0001).

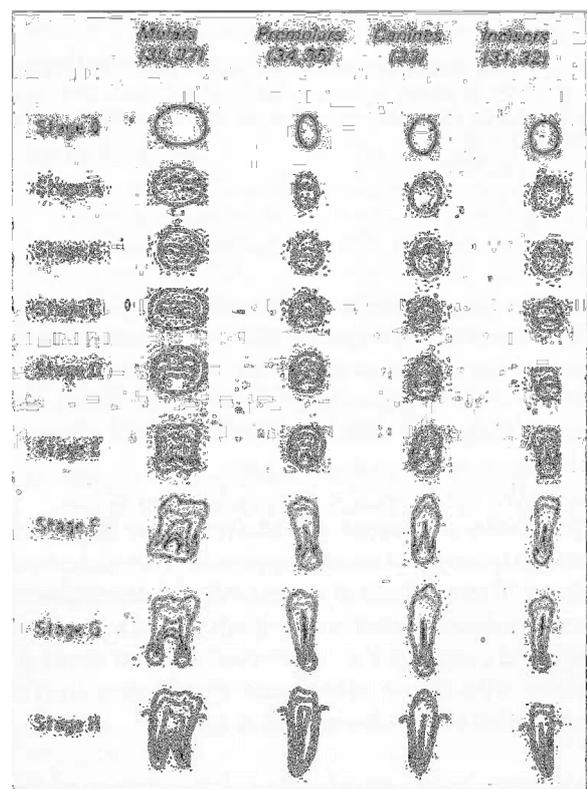
### Discussion

Forensic age diagnosis should comprise of the following: a physical examination, signs of sexual maturation, potentially age-relevant developmental disorders, examination of the left hand wrist radiograph, examination of the medial clavicular epiphyseal cartilage and a dental examination with an OPG. Dental methods of age estimation in adults are i) Morphological - Gustaafson (4), ii) Radiological: size of pulp chamber (5), iii) Kvaal and Solheim combined morphological and radiological measurements (6).

Dental maturity helps in estimating the chronological age because of low variability of dental indicators. There are different techniques used to estimate the age in forensic science. Among various dental age estimation techniques for children and young adults are those using the Atlas approach such as Schour and Massler (7), Moorrees et al (8) and Anderson (9). The alternative approach is by using the scoring systems; such as given by Demirjian et al (3) and Willems et al (10). Out of these approaches, the Demirjian's method is very popular and thus was selected for the purpose of this study. This system of age estimation is based on the degree of development of the whole tooth, and not upon clinical emergence, and is thus considered more reliable in determining dental age.

Overestimation of chronological age when using the method reported by Demirjian was consistently found by various authors

(10),(11),(12),(13). Demirjian et al had given their standards on children of French-Canadian origin.



**Fig. 2:** Graphical presentations of stages of tooth development, as given by Demirjian (2).

The reported overestimation in the literature has been attributed to the fact that the scores were not population-specific and hence the difference in age estimation. Likewise, the standards of dental age described by Demirjian et al. in 1973 and 1976

were not suitable for northern Turkish children (14). Each population of children may need their own specific standard for an accurate estimation of chronological age

	A	B	C	D	E	F	G	H
31				0	1.9	4.1	8.2	11.8
32			0	3.2	5.2	7.8	11.7	13.7
33			0	3.5	7.9	10	11	11.9

Fig. 3: Individual maturity scores as given by Demirjian for Males (2).

	A	B	C	D	E	F	G	H
31				0	2.4	5.1	9.3	12.9
32			0	3.2	5.6	8.0	12.2	14.2
33			0	3.8	7.3	10.3	11.6	12.4

Fig. 4: Individual maturity scores as given by Demirjian for Females (2)

New population-specific scores have been developed by various authors for their respective populations. Angelines Cruz-Landeira et al showed Demirjian's scores were inadequate after the age of 12 while Chaillet's scores offered useful information until 14 years of age (15). M Maber et al discovered that Haavikko's method for individual teeth using first premolar and second molar were most accurate; and more accurate than the mean value of all developing teeth. The most accurate method was by Willems than Demirjians (16). Cameriere et al showed that Willems method was better than that of Demirjian but was significantly less accurate than that of Cameriere (17). Few studies report accuracy with Age estimation using Demirjian's method (18).

A statistical analysis of this study revealed that the overestimation was more in the age group of 13-16years. The average difference was 2.04 years, which is significantly higher than the average difference of the younger age group of 6-12 years. The two tailed P value is less than 0.0001, which is statistically significant.

The advantages of this method include: (1) easy applicability, since no metric measurements were used, rather the stage of development was used as a marker, (2) better accuracy, since it was based on developmental stages and not on clinical

emergence, which is more affected by environmental and nutritional influences, (3) consideration of sufficient number of stages (A-H), thus decreasing the inter-observer disagreement, (4) sexual dimorphism is taken into consideration as the scores are different for boys and girls (5) uses OPGs which are extra oral radiographs and thus the problems caused by rigor mortis for intraoral radiography or clinical methods of age estimation are overcome.

Age	score	Age	score	Age	score	Age	score	Age	score
3	12.4	5.6	30.3	8.2	75.1	10.8	91.6	13.4	96
3.1	12.9	5.7	31.1	8.3	76.4	10.9	91.8	13.5	96.1
3.2	13.5	5.8	31.8	8.4	77.7	11	92	13.6	96.2
3.3	14	5.9	32.6	8.5	79	11.1	92.2	13.7	96.3
3.4	14.5	6	33.6	8.6	80.2	11.2	92.5	13.8	96.4
3.5	15	6.1	34.7	8.7	81.2	11.3	92.7	13.9	96.5
3.6	15.6	6.2	35.8	8.8	82	11.4	92.9	14	96.6
3.7	16.2	6.3	36.9	8.9	82.8	11.5	93.1	14.1	96.7
3.8	17	6.4	39	9	83.6	11.6	93.3	14.2	96.8
3.9	17.6	6.5	39.2	9.1	84.3	11.7	93.5	14.3	96.9
4	18.2	6.6	40.6	9.2	85	11.8	93.7	14.4	97
4.1	18.9	6.7	42	9.3	85.6	11.9	93.9	14.5	97.1
4.2	19.7	6.8	43.6	9.4	86.2	12	94	14.6	97.2
4.3	20.4	6.9	45	9.5	86.7	12.1	94.2	14.7	97.3
4.4	21	7	46	9.6	87.2	12.2	94.4	14.8	97.4
4.5	21.7	7.1	48.3	9.7	87.7	12.3	94.5	14.9	97.5
4.6	22.4	7.2	50	9.8	88.2	12.4	94.6	15	97.6
4.7	23.1	7.3	52	9.8	88.6	12.5	94.8	15.1	97.7
4.8	23.8	7.4	54	9.9	89	12.6	95	15.2	97.8
4.9	24.5	7.5	56	10	89.4	12.7	95.2	15.3	97.9
5	25.2	7.6	58	10.1	89.8	12.8	95.4	15.4	98
5.1	25.9	7.7	60	10.2	90.2	12.9	95.6	15.5	98.1
5.2	26.6	7.8	62	10.3	90.6	13	95.8	15.6	98.2
5.3	27.3	7.9	64	10.4	91	13.1	96	15.7	98.3
5.4	28	8	66	10.5	91.4	13.2	96.2	15.8	98.4
5.5	28.7	8.1	68	10.6	91.8	13.3	96.4	15.9	98.5
5.6	29.4	8.2	70	10.7	92.2	13.4	96.6	16	98.6

Fig. 5: Overall maturity scores as given by Demirjian for Males (2)

Age	score	Age	score	Age	score	Age	score	Age	score
3	12.4	5.6	30.3	8.2	75.1	10.8	91.6	13.4	96
3.1	12.9	5.7	31.1	8.3	76.4	10.9	91.8	13.5	96.1
3.2	13.5	5.8	31.8	8.4	77.7	11	92	13.6	96.2
3.3	14	5.9	32.6	8.5	79	11.1	92.2	13.7	96.3
3.4	14.5	6	33.6	8.6	80.2	11.2	92.5	13.8	96.4
3.5	15	6.1	34.7	8.7	81.2	11.3	92.7	13.9	96.5
3.6	15.6	6.2	35.8	8.8	82	11.4	92.9	14	96.6
3.7	16.2	6.3	36.9	8.9	82.8	11.5	93.1	14.1	96.7
3.8	17	6.4	39	9	83.6	11.6	93.3	14.2	96.8
3.9	17.6	6.5	39.2	9.1	84.3	11.7	93.5	14.3	96.9
4	18.2	6.6	40.6	9.2	85	11.8	93.7	14.4	97
4.1	18.9	6.7	42	9.3	85.6	11.9	93.9	14.5	97.1
4.2	19.7	6.8	43.6	9.4	86.2	12	94	14.6	97.2
4.3	20.4	6.9	45	9.5	86.7	12.1	94.2	14.7	97.3
4.4	21	7	46	9.6	87.2	12.2	94.4	14.8	97.4
4.5	21.7	7.1	48.3	9.7	87.7	12.3	94.5	14.9	97.5
4.6	22.4	7.2	50	9.8	88.2	12.4	94.6	15	97.6
4.7	23.1	7.3	52	9.8	88.6	12.5	94.8	15.1	97.7
4.8	23.8	7.4	54	9.9	89	12.6	95	15.2	97.8
4.9	24.5	7.5	56	10	89.4	12.7	95.2	15.3	97.9
5	25.2	7.6	58	10.1	89.8	12.8	95.4	15.4	98
5.1	25.9	7.7	60	10.2	90.2	12.9	95.6	15.5	98.1
5.2	26.6	7.8	62	10.3	90.6	13	95.8	15.6	98.2
5.3	27.3	7.9	64	10.4	91	13.1	96	15.7	98.3
5.4	28	8	66	10.5	91.4	13.2	96.2	15.8	98.4
5.5	28.7	8.1	68	10.6	91.8	13.3	96.4	15.9	98.5
5.6	29.4	8.2	70	10.7	92.2	13.4	96.6	16	98.6

Fig. 6: Overall maturity scores as given by Demirjian for Females (2).

The disadvantages of this method include: (1) consistent overestimation has been reported in literature, (2) it does not include third molars, (3) it cannot be used for children over 16 years of age, (4) it requires the use of mandibular teeth, in cases where the mandible has been crushed, dislocated and lost it cannot be used and (5) intra-observer and inter-observer error has been reported as the main cause for inaccuracy.

### Conclusion

Demirjian's original method, using seven mandibular teeth, is an accurate method of age estimation in children, especially, of the younger age group (6-12 years). However, it should not be considered as a reliable method when dealing with individuals who have completed root development in all of the seven teeth. The third molar should be included in the score for such cases or an alternative method should be used. This study did not use population specific scores; original scores given by Demirjian were used in spite of high accuracy. Larger sample size and further studies are required. The consistent overestimation reported in literature is specific to the older age group of around 12-16 years. The method is highly accurate in children <12 years of age.

### Acknowledgements

We acknowledge Dr. Sonali Kadam, Associate Professor and Dr. Prashant Salve, PG student, Department of Oral Medicine and Radiology, Government Dental College and Hospital, Mumbai for their valuable help.

### Conflict of interest

None Declared

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## Determination of proportional relationships between maxillary intercanine distance and various facial dimensions: A cross sectional study

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**Citation:** Kalambe CM. Determination of proportional relationships between maxillary intercanine distance and various facial dimensions: A cross sectional study. *Int J Eth Trauma Victimology* 2016; 2(1):30-7.doi: 10.18099/ijetv.v2i1.11132

### Article history

Received: April 11, 2016  
 Received in revised form: June 10, 2016  
 Accepted: June 15, 2016  
 Available online: July 25, 2016

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### Abstract

The study was conducted on 231 subjects (101 males and 130 females) ranged from 15 years to 69 years in age, with all natural upper anterior teeth present in mouth having no caries, severe attrition, erosion, fracture or restorations were selected. Inter-canthal distance (ICthD), inter-medialcanthal distance (IMCthD), interpupillary distance (IPD), interalar width (IAW), inter lip commissural distance (ICmD) and maxillary intercanine distance from tip to tip (ICD) were measured with a venire caliper with an accuracy of 0.01 mm. Obtained data was entered into Microsoft excel program and various statistical calculations and tests were applied to find out correlation between above mentioned various facial measurements and maxillary intercanine distance in male and female subjects. The statistical results of this study showed that there was positive correlation between intercanthal distance and maxillary intercanine distance in both male and female subjects. Other facial measurements showed no statistically significant correlation with maxillary intercanine distance. Suggesting that the intercanthal distance can be used as a preliminary method to determine the width of the maxillary anterior teeth while constructing complete denture in edentulous patients.

**Key words:** Inter-canthal distance (ICthD), inter-medialcanthal distance (IMCthD), interpupillary distance (IPD), interalar width (IAW), inter lip commissural distance (ICmD), maxillary intercanine distance (ICD)

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### Introduction

Selection of appropriate size of anterior teeth is extremely important in the success of denture prostheses. While constructing artificial denture the size, form, and colour of the teeth must be in harmony with the surrounding orofacial structures. When no pre-extraction records are available, selecting the proper anterior teeth size for edentulous patients can be difficult. A systematic approach is needed in such situations.

Several authors have attempted to identify normal tooth dimensions by conducting various studies and various anatomical measurements have been suggested including the interalar width (IAW), inter medial canthal distance (IMCthD),

interpupillary distance (IPD), inter lip commissural distance (ICmD), intercondylar width (ICdD) and bizygomatic distance (BZD) to establish a method of estimating or determining the appropriate width of maxillary anterior teeth .

A number of studies have been conducted to determine if there is any relationship between the various facial measurements namely interalar width and intercanine distance (1),(2),(3),(4), (5),(6),(7),(8),(9) inter-pupillary distance and intercanine distance(10),(11),(9) inter-medial canthal distance and maxillary inter-canine distance(9),(12),(13) inter-commissural width and maxillary anterior teeth (14), bizygomatic distance

and intercanine distance (9), intercondylar distance and intercanine distance (15). Various results were found by various authors.

Some results showed that men have wider facial measurements such as nose(1),(3) (8),(9), interpupillary distance (9) bizygomatic distance(9) and intercanine distance (1),(3) (8),(9) as compared to women. However no significant difference was found between sexes with respect of intercanthal distance (9).

Some results showed that there was no demonstrable correlation between interalar width and intercanine distance (1),(2)., interpupillary distance and intercanine distance (9), intercommissural width and maxillary anterior teeth (14). Suggesting that the width of the nose , interpupillary distance, intercommissural width would not be a reliable guide for selecting artificial anterior teeth.

While results of some other studies showed significant correlation between interalar width and maxillary intercanine distance in both men and women (4),(5),(7),(8),(9),(15), nasal width and the intercanine distance in female subjects but not in male subjects (3), intermedialcanthal distance and maxillary anterior teeth dimensions (9),(12),(13) , interpupillary distance and the combined mesiodistal width of maxillary anterior teeth amongst both male and female subjects (9), (11). Intercondylar distance and maxillary Intercanine distance (15). Suggesting that interalar width, intermedialcanthal distance, interpupillary distance, Intercondylar distance can be used as a reliable guide for maxillary anterior teeth selection.

#### Aim

To determine maxillary intercanine distance by measuring facial measurements, namely, intercanthal distance, intermedialcanthal distance, interpupillary distance, interalar distance and inter lip commissural distance to construct esthetically acceptable artificial denture.

#### Objectives

Objective of the study is to find if there is any proportional relationship between

- A) Intercanthal distance (ICthD) and maxillary intercanine distance (ICD);
- B) Intermedialcanthal distance (IMCthD) and maxillary intercanine distance (ICD);
- C) Interpupillary distance (IPD) and maxillary intercanine distance (ICD);

D) Interalar width (IAW) and maxillary intercanine distance (ICD) and E) Inter lip commissural distance (ICmD) and maxillary intercanine distance (ICD) to provide a guide for upper anterior teeth selection while constructing artificial denture.

#### Material and method

The study was conducted on 231 subjects (101males and 130 females), from among the patients attending the OPD in the dental department, Lokmanya Tilak nursing home and Nirmaladevi Dighe dispensary, Thane Municipal Corporation, Thane, Maharashtra, India.

#### Criteria for case selection

Subjects with all natural upper anterior teeth present in mouth having no caries, severe attrition, erosion, fracture or restorations were selected. Cases of anadontia, orthodontically treated cases, midline shift cases, migrated teeth, cases with a history of congenital anomaly, orbital disease, trauma or facial surgery were excluded.

All subjects were explained about the procedure and purpose of the study. Written consent from the subjects was obtained prior to study. Various facial measurements, namely, Intercanthal distance (ICthD), intermedialcanthal distance (IMCthD), interpupillary distance (IPD), interalar width (IAW), inter lip commissural distance (ICmD) and Intercanine distance from tip to tip (ICD) were measured with a venire caliper with an accuracy of 0.01 mm. (see the dig.)

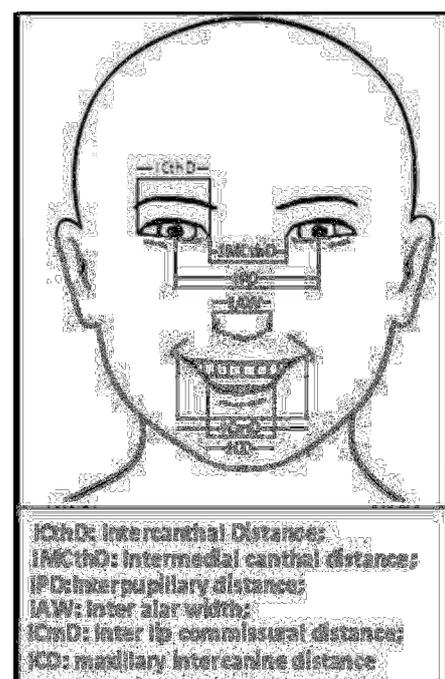


Fig. 1: showing various measurable distances on face

A) Inter-canthal distance (ICthD) or width of eye was estimated by measuring distance between inner and outer canthus of eye.  
 B) Inter-medialcanthal distance (IMCthD) was estimated by measuring distance between inner or medial canthi of two eyes.  
 C) Inter-pupillary distance (IPD) was estimated by measuring distance between the centers of the pupils of the two eyes.  
 D) Inter-laral width (IAW) or width of nose was estimated by measuring the external width of the ala of the nose at the widest point.

E) Inter-lip commissural distance (ICmD) or length of lip was estimated by measuring distance between right and left lip commissar and  
 F) Inter-canine distance (ICD) was estimated by measuring tip to tip distance of maxillary canines.

Collected data was entered into Microsoft excel program and various statistical calculations and tests were applied to find out correlation between above mentioned various facial measurements and maxillary intercanine distance in Indian male and female subjects.

**Observations and discussion**

**Table 1.** Distribution of subjects age wise

Sr No	Age Group	Male (%)	Female (%)	Total (%)
1	15-20	10 (9.9%)	13 (10%)	23 (9.95%)
2	21-30	24 (23.76%)	51 (39.23%)	75 (32.46%)
3	31-40	31 (30.69%)	35 (26.92%)	66 (28.57%)
4	41-50	13 (12.87%)	22 (16.92%)	36 (15.58%)
5	51-60	15 (14.85%)	5 (3.84%)	19 (8.22%)
6	61-70	8 (7.92%)	4 (3.07%)	12 (5.19%)
	TOTAL	101	130	231

**Table 2:** Difference between various facial measurements in male and female

Indicator	Male			Female			Std Error between M and F	Relative Deviate (Z value)	Significance of difference
	MEAN (SD)	MEDIAN	MODE	MEAN (SD)	MEDIAN	MODE			
ICthD	3.15 (0.15)	3.1	3	3.02 (0.1)	3	3	0.01732	7.5057	Significant
IMCthD	2.94 (0.22)	2.9	2.9	2.87 (0.25)	2.9	2.9	0.03129	2.2371	Significant
IPL	5.75 (0.39)	5.7	5.6	5.54 (0.29)	5.6	5.6	0.04638	4.5278	Significant
IAW	3.48 (0.3)	3.5	3.4	3.12 (0.28)	3.1	3	0.03865	9.0556	Significant
ICmD	4.92 (0.34)	4.9	5	4.57 (0.32)	4.6	4.5	0.04395	7.9635	Significant
ICD	3.17 (0.14)	3.2	3	3.03(0.099)	3	3	0.01395	10.0358	Significant

Since  $Z > 2$ , therefore  $p < 0.05$  in all the facial measurements in male and female. Thus the difference in facial measurements in males and females is statistically significant.

The study was conducted on 231 subjects (101 males and 130 females) ranged from 15 years to 69 years in age. Most of the patients fall in 21 to 40 yr age group. (See the table 1.)

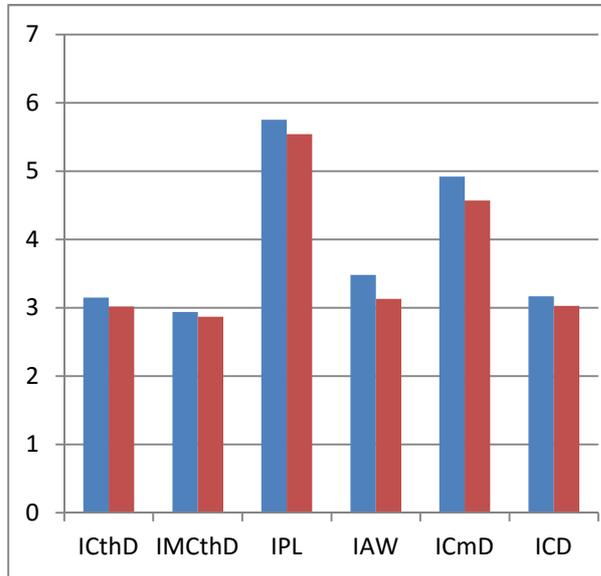
The observations showed that the mean intercanthal distance was 3.15 mm, standard deviation (SD) was 0.15, median was 3.1 and mode was 3 in males with range from 2.9 mm to 3.6 mm and The mean intercanthal distance was 3.02 mm,

standard deviation (SD) was 0.1, median was 3 and mode was 3 with range from 2.8 mm to 3.2 mm in females.

The ratio of averages between the mean maxillary intercanine distance (ICD) to mean intercanthal distance (ICthD) was 1:0.99 in both males in females.

The mean intermedialcanthal distance was 2.94 mm, standard deviation (SD) was 0.22, median was

2.9 and mode was 2.9 in males with range from 2.4 mm to 3.5 mm and The mean intermedialcanthal distance 2.87 mm, standard deviation (SD) was 0.25, median value was 2.9 and mode value was 2.9 with range from 2.3 mm to 3.9 mm in females.



**Graph 1:** Comparison between mean of various facial measurements in male and female

The ratio of averages between the mean maxillary intercanine distance (ICD) to the mean intermedialcanthal distance (IMCthD) was 1:0.93 in males and the proportion or ratio of averages between the mean maxillary intercanine distance (ICD) to the mean intermedialcanthal distance (IMCthD) was 1:0.94 in females.

Mean interpupillary distance was 5.75 mm, standard deviation (SD) was 0.39, median was 5.7 and mode was 5.6 with range from 5 mm to 7 mm in males and The mean interpupillary distance was 5.54 mm, standard deviation (SD) was 0.29, median was 5.6 and mode was 5.6 with range from 4.8 mm to 6.3 mm in females.

The ratio of averages between the mean maxillary intercanine distance (ICD) to the mean interpupillary distance (IPD) was 1:1.81 in males and the proportion or ratio of averages between the mean maxillary intercanine distance (ICD) to the mean interpupillary distance (IPD) was 1:1.83 in females.

The mean interalar width was 3.48 mm, standard deviation (SD) was 0.3, median was 3.5 and mode was 3.4 with range from 2.7 mm to 4.2 mm in

males and the mean interalar width was 3.12 mm, standard deviation (SD) was 0.28, median was 3.1 and mode was 3 with range from 2.5 mm to 3.9 mm in females.

The ratio of averages between the mean maxillary intercanine distances (ICD) to the mean interalar width (IAW) was 1:1.09 in males and the proportion or ratio of averages between the mean maxillary intercanine distances (ICD) to the mean interalar width (IAW) was 1:1.03 in females.

The mean inter lip commissural distance was 4.92 mm, standard deviation (SD) was 0.34, median was 4.9 and mode was 5 with range from 4.1 mm to 5.8 mm in Indian males and the mean inter lip commissural distance was 4.57 mm, standard deviation (SD) was 0.32, median was 4.6 and mode was 4.5 with range from 3.6 mm to 5.5 mm in Indian females.

The ratio of averages between the mean maxillary intercanine distance (ICD) to the mean inter lip commissural distance (ICmD) was 1:1.55 in males and the proportion or ratio of averages between the mean maxillary intercanine distance (ICD) to the mean inter lip commissural distance (ICmD) was 1:1.51 in females.

The mean maxillary inter canine distance from tip to tip was 3.17 mm, standard deviation (SD) was 0.14, median was 3.2 and mode was 3 with range from 2.9 mm to 3.6 mm in males and the mean maxillary inter canine distance from tip to tip was 3.03 mm, standard deviation (SD) was 0.09, median was 3 and mode was 3 with range from 2.8 mm to 3.2 mm in females.

It was observed that all facial measurements were greater in males than in females. Data obtained was subjected to statistical analysis. Standard error of difference (SE) and relative deviate (Z value) were calculated. The result showed  $Z > 2$ , therefore difference between male and female values was statistically significant. (See table 2; graph 1)

It was observed that maxillary intercanine distance from tip to tip (ICD) and Intercanthal distance (ICthD) was equal in length in 35 male subjects (34.65%) and in 89 female subjects.(68.46%).

Maxillary Inter canine distance was greater than intercanthal distance (ICthD) in length in 35 male subjects (34.65 %) and in 22 female subjects. (16.92%)

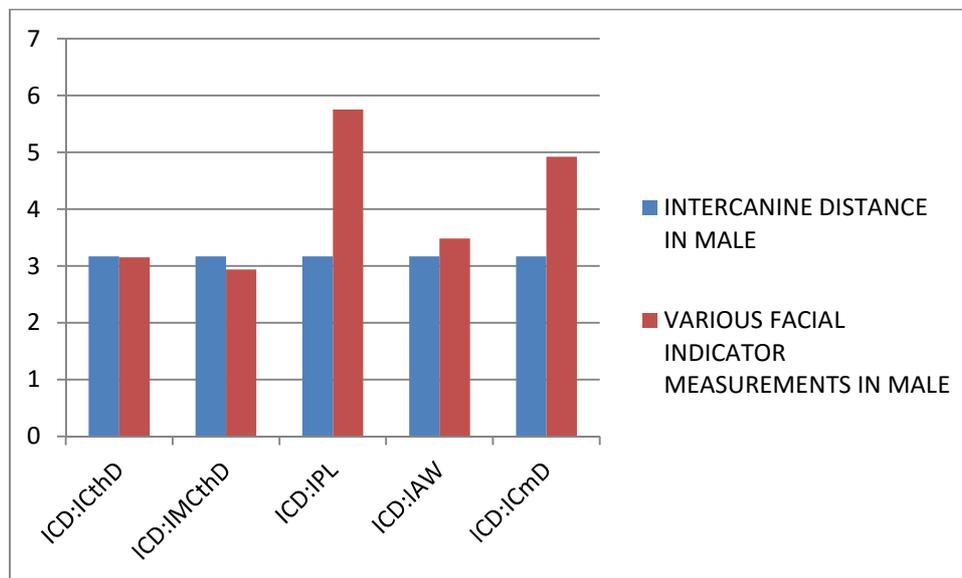
Maxillary intercanine distance was smaller than intercanthal distance (ICthD) in length in

31 male subjects (30.69%) and in 19 female subjects. (14.61%)

**Table 3:** Difference between various facial measurements and maxillary intercanine distance (ICD) in male

Indicator	Mean	SD	Median	Mode	Std. Error (SE) bet other indicator and ICD	Relative Deviate (Z Value)	Significance of Difference
ICthD	3.15	0.15	3.1	3	0.02	1	Insignificant
IMCthD	2.94	0.22	2.9	2.9	0.025	9.2	Significant
IPL	5.75	0.39	5.7	5.6	0.04123	62.57	Significant
IAW	3.48	0.3	3.5	3.4	0.03162	9.8	Significant
ICmD	4.92	0.34	4.9	5	0.03659	47.82	Significant

Mean (ICD) = 3.17; SD (ICD) = 0.14; Median (ICD)= 3.2 ; Mode (ICD) =3 & n=101

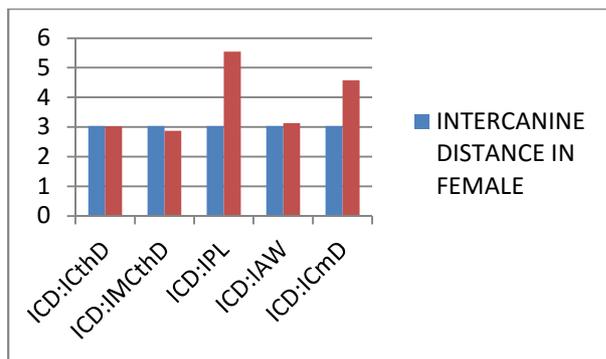


**Graph2:** Comparison between mean of various facial measurements with maxillary intercanine distance in males.

**Table 4:** Difference between various facial measurements and maxillary intercanine distance (ICD) in female

Indicator	Mean	SD	Median	Mode	Std. Error (SE) bet other indicator and ICD	Relative Deviate (Z Value)	Significance of Difference
ICthD	3.02	0.1	3	3	0.008813	1.1346	Insignificant
IMCthD	2.87	0.255	2.9	2.9	0.02236	7.1556	Significant
IPL	5.54	0.29	5.6	5.6	0.02544	98.6635	Significant
IAW	3.13	0.28	3.1	3	0.02449	4.0832	Significant
ICmD	4.57	0.32	4.6	4.5	0.02807	54.8628	Significant

Mean (ICD) = 3.03; SD (ICD) = 0.01; Median (ICD)= 3 ; Mode (ICD) =3 & n=130



**Graph3:** Comparison between mean of various facial measurements and maxillary intercanine distance in females.

The Mean, standard deviation, standard error of difference (SE) and relative deviate (Z value) were

calculated between various facial measurements and maxillary intercanine distance in male and female subjects. The result showed  $Z > 2$ , therefore  $p < 0.05$  in all the facial measurements except intercanthal distance in males and in females, indicating that the difference in all facial measurements except intercanthal distance in males and females is statistically significant.

Whereas  $Z < 2$ , therefore  $p > 0.05$  in intercanthal distance and maxillary intercanine distance in males and in females, indicating that the difference between intercanthal distance and maxillary intercanine distance is statistically insignificant. (Refer table 3 and table 4)

**Table 5:** Observed Proportion of intercanine distance with various facial measurements, in males and females

Variants	Male (n=101)			Female (n=130)		
	ICD = 0 (%)	ICD > 0 (%)	ICD < 0 (%)	ICD =0 (%)	ICD > 0 (%)	ICD < 0 (%)
ICthD	35 (34.65%)	35 (34.65%)	31 (30.69%)	89 (68.46%)	22 (16.92%)	19 (14.61%)
IMCthD	6 (5.94%)	75 (74.25%)	20 (19.80%)	21 (16.15%)	89 (68.46%)	20 (15.38%)
IPL	0	0	101 (100%)	0	0	130 (100%)
IAW	12 (11.88%)	10 (9.90%)	79 (78.21%)	23 (17.69%)	45 (34.61%)	62 (47.69%)
ICmD	0	0	101(100%)	0	0	130 (100%)

It was observed that average difference between maxillary Intercanine distance (ICD) and intercanthal distance (ICthD) was 0.02 mm with range from -0.3 mm to 0.2 mm in male subjects ( $r=0.6$ ) and average difference between maxillary Intercanine distance (ICD) and intercanthal distance (ICthD) was 0.002 mm with range from -0.2 mm to 0.2 mm in female subjects ( $r=0.78$ ).

It was observed that maxillary intercanine distance was bigger than length of eye in cases with diastemas; wide U or squarish arch; missing posterior causing distal displacement of anterior teeth and persons with small eyes, while maxillary intercanine distance was lesser than intercanthal distance in cases with crowding or narrower arch and v shaped arch.

The maxillary intercanine distance from tip to tip (ICD) and Intermedialcanthal distance (IMCthD) was equal in length in 6 male subjects (5.94 %) and in 21 female subjects (16.15%).

Maxillary Intercanine distance was greater than Intermedialcanthal distance (IMCthD) in length in 75 male subjects (74.25 %) and in 89 female subjects (68.46 %).

Maxillary Intercanine distance was smaller than Intermedialcanthal distance (IMCthD) in length in 20 male subjects (19.80 %) and in 20 female subjects (15.38 %).

It was observed that average difference between Intercanine distance (ICD) and intermedialcanthal distance (IMCthD) 0.22 mm with range from -1.2 mm to 0.3 mm in male subjects ( $r=-0.01$ ) and average difference between Intercanine distance (ICD) and intermedialcanthal distance (IMCthD) was 0.15 mm with range from -0.8 mm to 1 mm in female subjects ( $r=-0.063$ ).

Interpupillary distance (IPD) was greater than maxillary Intercanine distance (ICD) in length in all 231 subjects (100 %).

The average difference between maxillary intercanine distance (ICD) to Interpupillary

distance (IPD) was 2.58 with range of difference of 1.9 to 3.6 mm in male subjects. ( $r=0.33$ ) and the average difference between Maxillary intercanine distance (ICD) to Interpupillary distance (IPD) was 2.51 mm with range of difference of 1.7 mm to 3.2 mm in female subjects ( $r=0.13$ ).

Maxillary intercanine distance from tip to tip (ICD) and Interalar width (IAW) was equal in length in 12 male subjects (11.88 %) and in 23 female subjects. (17.69%)

Maxillary intercanine distance was greater than Interalar width (IAW) in length in 10 male subjects (9.90 %) and in 45 female subjects. (34.61 %)

Maxillary intercanine distance was smaller than Interalar width (IAW) in length in 79 male subjects (78.21 %) and in 62 female subjects (47.69 %).

It was observed that average difference between Intercanine distance (ICD) and interalar width (IAW) was 0.3 mm with range from -0.6 mm to 1.1 mm in male subjects ( $r= 0.09$ ) and average difference between Intercanine distance (ICD) and interalar width (IAW) was 0.09mm with range from -0.5 mm to 0.8 mm in female subjects ( $r=0.23$ ).

Inter lip commissural distance (ICmD) was greater than Maxillary Intercanine distance (ICD) in length in all 231 subjects (100 %).

The average difference between maxillary intercanine distance (ICD) and Inter lip commissural distance (ICmD) was 1.75 mm with range of difference of 0.9 mm to 2.6 mm in male subjects. (correlation coefficient,  $r=0.25$ ) and the average difference between maxillary intercanine distance (ICD) and Inter lip commissural distance (ICmD) was 1.54 mm with range of difference of 0.5 mm to 2.4 mm in female subjects ( $r=0.17$ ).

## Results

The data obtained from 231 subjects (101 males and 130 females) was subjected to statistical analysis and the results obtained are as follows:

A) The mean of intercanthal distance was slightly smaller than the mean of maxillary intercanine distance in both males (mean 3.15 mm and 3.17 mm, respectively) and in female (mean 3.02 mm and 3.03 mm, respectively). The difference between intercanthal distance (ICthD) and maxillary intercanine distance (ICD) was statistically insignificant ( $Z < 2$ ) in both males and females.

B) The mean of intermedialcanthal distance (IMCthD) was smaller than the mean of maxillary intercanine distance in males (mean 2.94 mm and 3.17 mm, respectively) and in female (mean 2.87 mm and 3.03 mm, respectively).

The intermedialcanthal distance (IMCthD) in 5.94% of male and 16.15% of female cases showed positive correlation with maxillary intercanine distance (ICD), however no statistically significant correlation between intermedialcanthal distance (IMCthD) and maxillary intercanine distance (ICD) was found ( $Z > 2$ ).

C) The mean of interpupillary distance (IPD) was greater than the mean of maxillary intercanine distance in males (mean 5.75 mm and 3.17 mm, respectively) and in female (mean 5.54 mm and 3.03 mm, respectively).

The difference between interpupillary distance (IPD) and maxillary intercanine distance (ICD) was statistically significant in both males and females, thus statistically significant correlation between interpupillary distance (IPD) and maxillary intercanine distance (ICD) was not found. ( $Z > 2$ )

D) The mean of interalar width (IAW) was greater than the mean of maxillary intercanine distance in males (mean 3.48 mm and 3.17 mm, respectively) and in female (mean 3.12 mm and 3.03 mm, respectively).

The Interalar width (IAW) in 11.88% of male and 17.96% of female cases showed positive correlation with maxillary intercanine distance (ICD), however no statistically significant correlation between The Interalar width (IAW) and maxillary intercanine distance (ICD) was found. ( $Z > 2$ ).

E) The mean of inter lip commissural distance (ICmD) was greater than the mean of maxillary intercanine distance in males (mean 4.92 mm and 3.17 mm, respectively) and in female (mean 4.57 mm and 3.03 mm, respectively)

The difference between inter lip commissural distance (ICmD) and maxillary intercanine distance (ICD) was statistically significant, ( $Z > 2$ ), thus statistically significant correlation between interpupillary distance (IPD) and maxillary intercanine distance (ICD) was not found.

The results of the study showed a significant correlation between intercanthal distance and maxillary intercanine distance in almost all

subjects indicating Maxillary intercanine distance may be estimated by measuring intercanthal distance and vice versa.

These results could be used as a helpful guide for the selection of upper anterior teeth while constructing esthetically acceptable artificial complete denture and also in the field of forensic sciences for facial reconstruction by using existing dental guidance.

#### **Clinical application**

1. Construction of complete denture in dentistry.
2. Facial reconstructions in forensic sciences.

#### **Conclusion**

The statistical results of this study showed that there was positive correlation between intercanthal distance and maxillary intercanine distance in both male and female Indian subjects. Though intermedialcanthal distance and Interalar width in 27 % and 35% of total cases respectively, showed positive correlation with maxillary intercanine distance. However, no statistically significant correlation between intermedial canthal distance and maxillary intercanine distance and between Interalar width and maxillary intercanine distance could be demonstrated.

Also no demonstrable correlation between the interpupillary distance and maxillary intercanine distance as well as inter lip commissural distance and maxillary intercanine distance was found, suggesting that the interpupillary distance and inter lip commissural distance are not reliable guides for determining maxillary intercanine distance for edentulous patients.

Within the limitations of this study, the results suggest that intercanthal distance can be used as a preliminary method to determine the width of the maxillary anterior teeth for construction of complete denture in edentulous patients.

Further studies on large scale are required in different Indian racial groups, to determine differences in measurements in them to reinforce the results in the present study.

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## The effect of cyanide exposure to larvae weight for post mortem interval estimation

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**Citation:** Wiraagni IA, Nurhantari YN, Umniyati SR. The Effect of Cyanide Exposure to Larvae Weight for Post Mortem Interval Estimation. *Int J Eth Trauma Victimology* 2016; 2(1):38-43. doi: 10.18099/ijetv.v2i1.11133

### Article history

Received: February 02, 2016  
Received in revised form: June 07, 2016  
Accepted: June 18, 2016  
Available online: July 25, 2016

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### Abstract

Flies are one type of insect, which decompose the organic component in animals, and human cadavers. Therefore, the insects can be used to help the investigators related to human law. One of the methods to determine Post Mortem Interval [PMI] was by identifying the insects that come in the decay process. Some chemicals can affect the development of the insect and its life cycle. Cyanide is widely used to commit murder in Indonesia. The effect of cyanide on the development and life cycle of insects is a very interesting field to study. The purpose of this study was to determine the effect of cyanide exposure to larvae weight for PMI estimation. This research was an experimental research that used larvae of Wistar rat carcass. The control group was killed by neck dislocation, while experimental group were killed by oral lethal doses of cyanide. Data were obtained from the measurement and examination of larvae, started from the 1<sup>st</sup> day until 4<sup>th</sup> day after death. *Chrysomya*, *Sarcophaga*, and *Lucilia* larvae were identified from this study. *Sarcophaga* larvae first appeared and next day followed by *Chrysomya* and *Lucilia*. There were significant differences in *Chrysomya* larvae weight. There were *Chrysomya* third instar larvae on the 4<sup>th</sup> day on cyanide group, with 56.4±16.8 mg of weight. There were *Chrysomya* third instar larvae on the 4<sup>th</sup> day on control group, with 30.4±5.5 mg of weight. The differences of larvae's weight, among *Sarcophaga* and *Lucilia* larvae, could not be determined because there were not enough samples. *Chrysomya* third instar larvae of cyanide group significantly heavier than control group on 4<sup>th</sup> day. The differences of larvae weight, among *Sarcophaga* and *Lucilia* larvae, could not be determined because there were not enough samples.

**Keywords:** cyanide, larvae stage, larvae weight

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### Introduction

Forensic entomology is one branch of forensic science, which insects are used for the investigation of human or animal case (1),(2). Insects are group of animals that have a wide spread in all habitats, with a wide range of

environmental conditions (3). Insects are able to survive by consuming a variety of foods such as carrion (*necrophagous*). Flies are one example of necrophagous insects that feed on carrion, especially corpses (cadaver), so that the animal

can be used as a guide to determine the PMI estimation (4).

The species of *Diptera*/flies (e.g., *Calliphoridae*, *Muscidae*, *Sarcophagidae*, *Stratiomyidae*) and *Coleoptera*/beetles (e.g., *Dermestidae*, *Cleridae*, *Silphidae*) have been associated with a criminal investigation that were used for PMI estimation (5) Other studies described types of necrophagous insect frequently encountered, such as *Diptera*/flies (*Calliphoridae*, *Muscidae*, *Fanniidae*, *Sarcophagidae*, *Piophilidae*, *Sepsidae*, *Phoridae*, *Sphaeroceridae*, *Heleomyzidae*, *Stratiomyidae*, *Drosophilidae*, *Ephydriidae*, *Trichoceridae* family); *Coleoptera*/beetles (*Staphylinidae*, *Histeridae*, *Silphidae*, *Cleridae*, *Trogidae*, *Dermestidae*, *Scarabaeidae*, *Geotrupidae*, *Nitidulidae* family); *Lepidoptera*/butterfly; *Tineidae*/clothes moth; *Hymenoptera*/bees (*Ichneumonidae*, *Pteromalidae*); mites; and ants (6), (7), (8).

Flies Activities are influenced by many factors, both internal and external. The internal factor is the character of fly species itself. The ambient temperature, humidity, rainfall, food, geography, contaminants (toxins) are the examples of external factors. Some chemicals such as triazolam, oxazepam, alimemazin, chloripiramin, phenobarbital, mercury, malathion, amitriptyline, nortriptyline, cocaine, heroin, morphine, and phenicyclidin could affect larvae life cycle (8),(9). Some research was conducted in Wistar rats, used amitriptyline and morphine. Amitriptyline might block the growth of flies larvae (8),(10). Morphine caused larvae growth significantly longer and heavier (on Wistar rat carcass) (11).

The effects of cyanide are very fast and can lead to death within a few minutes. According to the American Association of Poison Control Center Toxic Exposure Surveillance System, 5 of 242 cases in 2007 and 3 of 238 cases in 2008 were deadly exposure. Cyanide come into the body via parenteral, inhalation, oral, or dermal absorption (12). There was no clear relationship between the effects of these substances with the average weight of larvae. Wistar rats were used as a model for estimating PMI for human cyanide poisoning death case. This study was aimed to determine the effect of cyanide exposure to larvae weight for PMI estimation.

#### Materials and methods

This research was an experimental research, used larvae of Wistar rat carcass to determine the effect of cyanide exposure to larvae weight for PMI estimation. The samples of this study were 12

healthy male Wistar rats. The average rats age were about three to four months, the weight were about 150 grams, which were obtained from the Pharmacology and Toxicology Laboratory of Medicine Faculty UGM. The data were collected from direct measurement and inspection of larvae, starting from 1<sup>st</sup> to 4<sup>th</sup> days after death. In this study, control group were killed by neck dislocation, while experimental group were killed by lethal doses cyanide orally, LD100 (6 mg/kg). After rats were killed, they were placed in Biology Forest to be rotted naturally. Larvae measurement and posterior spiracles examination were conducted at Parasitology Laboratory. The clearance from Research Ethic Committee was obtained for this study.

Larvae weights were measured with scale (in mg). Larvae type was determined by observation of the larvae posterior spiracles. First instar larvae: there was 1 spiracle slit. Second instar larvae: there were 2 spiracle slits. Third instar larvae: there were 3 spiracle slits. The 1<sup>st</sup> day until the 4<sup>th</sup> day after death (12.00 a.m.), the observed larvae were taken as many as 10% of the total existing larvae by using simple random sampling. The larvae were inserted in 70% alcohol containing tube and transported to Parasitology Laboratory for examination.

The temperature and humidity of the Biology Forest were recorded. Normality test of data used Kolmogorov-Smirnov test. The test results p value > 0.05, then data was normally distributed. Univariate analysis was used to analyze the descriptive data for larvae. Independent sample T-test was used to analyze the average differences between two groups.

#### Result and discussion

Decay process was occurred in Biology Forest. After the rats were killed, they were put in a cage, and laid on the ground. Temperature and humidity were measured every morning (04.30 a.m.) and noon (12.00 a.m.) (Table 1). Biology Forest was a miniature forest, with a variety of large trees and other plants. This research was done during transition season, from dry season to rainy season. *Chrysomya*, *Sarcophaga*, and *Lucilia* larvae were identified from this study. *Sarcophaga* third instar larvae first appeared (2<sup>nd</sup> day on control group and 3<sup>rd</sup> day on cyanide group), next day followed by *Chrysomya* and *Lucilia* (3<sup>rd</sup> day on control group and 4<sup>th</sup> day on cyanide group). *Sarcophaga* third instar larvae first appeared, because *Sarcophaga* is ovovivipar. *Sarcophaga* interested in carcasses or corpses in almost situations, either exposed or

sheltered from the sun, either wet or dry environment, and on the inside or outdoors. The eggs hatch in the uterus of female flies, and first

instar larvae of *Sarcophaga* delivered if finding right environment (6).

**Table 1:** Temperature and humidity

Incubation Period	Temperature and Humidity			
	04.30 a.m.		12.00 a.m.	
	°C	%	°C	%
1	-	-	29	47
2	-	-	30	51
3	25	71	25	71
4	25	74	23	84

The average weight of *Chrysomya* third instar larvae on the control group tended to increase from 3<sup>th</sup> to 4<sup>th</sup> days. In LD100 cyanide group, there

were no larvae in 1<sup>st</sup> to 3<sup>th</sup> days, after that the average weight of larva is 56,4±16,8 mg (Table 2).

**Table 2:** Average weight of *Chrysomya* third instar larvae on control and Cyanide Group

Incubation Period (Day)	Control	Cyanide LD100
	Weigth mg	Weigth mg
1	-	-
2	-	-
3	7,2±2,2	-
4	30,4±5,5	56,4±16,8

Cyanide is common used in insecticide. The heaviest *Chrysomya* larvae cyanide group was found on 4<sup>th</sup> day, because cyanide level in rats had already begun to fall, so the insects began to eat and to lay eggs. Study in rabbits was reported that cyanide level fallen down 20 minutes after death(13). Another study explained that high ambient temperature further accelerate the decline of cyanide level (14),(15).

The average length of *Chrysomya* adults flies were 6-14 mm, majority having metallic color ranging from green, blue, bronze or black. *Chrysomya* adults flies come to dead body, about 10 minutes after death (16). Length of *Chrysomya* egg was about 1 mm and 50 -200 eggs could be laid in one spawning. Female fly can lay up to thousands eggs, on the whole body of corpse (17). The eggs hatch approximately 18-24 hours at 25°C and 10 hours at 37°C. First instar larvae became third instar larvae taken 5-6 days at 36°C. The larvae will mature into pupae for 7-8 days and migrate from the body, to find the right place. Adult flies can lay eggs, after 6-7 days (18).

Based on the table 2, we found that average weight of *Chrysomya* third instar larvae on control

group was lower than cyanide group. In the table 3, the average differences between two groups on 4<sup>th</sup> day was significant statistically (*p-value*: 0,002). It was because the rats on cyanide group relatively intact (because of delaying in hatching), compared with control group on the 3<sup>rd</sup> day. On cyanide group, third instar larvae began to emerge on 4<sup>th</sup> day. They had more food sources than control group. The number of these food sources caused the larvae ate more food, so they had higher number of weight. Besides, *Chrysomya* larvae have a longer life cycle than *Sarcophaga* and *Lucilia*. In control group, rats body had already decreased since the 3<sup>rd</sup> day, fewer food available for larvae and the other insect.

*Sarcophagidae* family (flesh flies) has more than 2000 species that can be found throughout the world, most species were found in tropical areas with warm temperatures. *Sarcophaga* adult flies have 2-14 mm in length, with black gray stripe color on the chest. This fly has three dark stripes on the chest. On the stomach has a complexion like a chessboard. Some species have bright red eye color (19).

**Table 3:** Average differences between control and Cyanide group

Incubation Period (Day)	Control		Cyanide LD100	
	<i>Chrysomya</i> Weighth mg	Weighth mg	<i>Chrysomya</i> p-value	95% CI
1	-	-	-	-
2	-	-	-	-
3	7,2±2,2	-	-	-
4	30,4±5,5	56,4±16,8	<b>0,002</b>	<b>(-40 - -11,9)</b>

The average weight of *Sarcophaga* third instar larvae on the control group tended to increase from 2<sup>nd</sup> to 3<sup>rd</sup> days. In LD100 cyanide

group, there were no larvae in 1<sup>st</sup> to 3<sup>th</sup> days, after that the average weight of larva is 54, 1±1, 3 mg (Table 4).

**Table 4:** Average weight of *Sarcophaga* third instar larvae on control and Cyanide group

Incubation Period (Day)	Control	Cyanide LD100
	Weighth mg	Weighth mg
1	-	-
2	5,7±5,6	-
3	53,5±34,7	-
4	-	54,1±1,3

*Sarcophaga* is ovovivipar, so the eggs hatch in the uterus of female flies, and first instar larvae of *Sarcophaga* delivered if finding right environment. The female lays 20-40 first instar larvae directly in the right place. Only within 3-4 days, the larvae

were already in the final stages of larva and ready to become pupae. *Sarcophaga* pupa size were 5-10 mm. Female adult flies can reproduce again after 10-14 days (20).

**Table 5:** Average differences between control and Cyanide group

Incubation Period (Day)	Control		Cyanide LD100	
	<i>Sarcophaga</i> Weighth mg	Weighth mg	<i>Sarcophaga</i> p-value	95% CI
1	-	-	-	-
2	5,7±5,6	-	-	-
3	53,5±34,7	-	-	-
4	-	54,1±1,3	-	-

Based on the figure table 5, average differences in larvae weight on cyanide and control group, could not be found. It was because there were no larva from both groups on the same day. However, there was a delay in first instar larva laying on cyanide group. *Sarcophaga* fly delayed to lay its first instar, until the cyanide level falled down. Rats body on cyanide group were relatively intact compared with control group on 2<sup>nd</sup> day. However,

there were many *Chrysomya* third instar larvae which were longer than *Sarcophaga* larvae. There was competition between *Chrysomya* and *Sarcophaga*, in obtaining food. As a result, the food sources for *Sarcophaga* larvae were similar to the control group. Besides, first Instar *Sarcophaga* (3-4 day) faster become pupa than *Chrysomya* (5-6 day) (6).

The average weight of *Lucilia* third instar larvae on the control group tended to increase from 3<sup>rd</sup> to

4<sup>th</sup> days. In LD100 cyanide group, there were no larvae in 1<sup>st</sup> to 4<sup>th</sup> (Table 6).

**Table 6:** Average weight of *Lucilia* third instar larvae on control and Cyanide group

Incubation Period (Day)	Control Weighth mg	Cyanide LD100 Weighth mg
1	-	-
2	-	-
3	17,6±8,4	-
4	29,9±8,9	-

The *Lucilia* adult flies have 8 mm body length, metallic green body color, black colored legs, and 7.5 mm wing venation. *Lucilia* adult flies not only useful in investigation, but also played role in larvae therapy. These larvae could eat dead tissue and bacteria naturally, as well as released antiseptic substances (21). *Lucilia sericata* larvae were placed on necrotic tissue, then wrapped so

that the larvae could work. Larval activity could stimulate growth of healthy tissue (22). *Lucilia* adult flies could lay up to 200 eggs in carrion. At 27° C, the eggs required 18 hours to hatch into larvae, while at 21°C taken 21 hours. First *Lucilia* instar larvae taken 3 days at 27 ° C became pupae, whereas at 20 ° C taken 4 days (23).

**Table 7:** Average differences between control and Cyanide group

Incubation Period (Day)	Control <i>Lucilia</i> Weighth mg	Cyanide LD100 <i>Lucilia</i> Weighth mg	<i>p-value</i>	95% CI
1	-	-	-	-
2	-	-	-	-
3	17,6±8,4	-	-	-
4	29,9±8,9	-	-	-

Based on the figure table 7, average differences in larvae weight on cyanide and control group, could not be found. It was because there were no larva from both groups on the same day.

PMI estimation could be summarized form significant results from Independent Sapmle T-tests (Table 3). There were *Chrysomya* third instar larvae on the 4<sup>th</sup> day on cyanide group, with 56,4±16,8 mg of weight. There were *Chrysomya* third instar larvae on the 4<sup>th</sup> day on control group, with 30,4±5,5 mg of weight.

**Conclusion**

*Chrysomya* third instar larvae of cyanide group significantly heavier than control group on 4<sup>th</sup> day. The differences of larvae weight, among *Sarcophaga* and *Lucilia* larvae, could not be determined because there were no enough samples.

**Acknowledgement**

This research was a part of thesis in forensic pathologist educational programme and has been presented in Bandung International Scientific Meeting on Parasitology and Tropical Disease. This research was funded by “Dana Masyarakat Grant” from Faculty of Medicine Gadjah Mada University. Writer expresses gratitude to all people who have helped in the process of this research completion. Many thanks for all lecturers and administration staffs who always guide, educate, and help the writer to finish this research.

**Conflict of Interest**

None declared

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## Recent legal aspects of medical negligence

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**Citation:** Bala R, Chanana A. Recent legal aspects of medical negligence. *Int J Eth Trauma Victimology* 2016; 2(1):44-.7. doi: 10.18099/ijetv.v2i1.11134

### Article history

Received: March 21, 2016  
 Received in revised form: June 13, 2016  
 Accepted: June 25, 2016  
 Available online: July 25, 2016

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### Abstract

In spite of following one of the best management strategies, by the competent doctors with best available infrastructures in patient care, undesired results harming the patient cannot be avoided. Does it mean all these undesired results causing damage to the patient are as a result of medical negligence? Nowadays, patients are more aware of their rights on account of increased literacy level, role of print, electronic and social media and above all enactment of new law i.e. Consumer Protection Act 1986. Though the question of medical negligence is decided by Courts, but Courts on their own are not trained in medical science. Their decision is based on expert's opinion. Judges apply the basic principle of law in conjunction with the law of land to make a decision. Reasonableness and prudence are the guiding factors. This paper deals with the legal aspects of medical negligence i.e. what is negligence and its type and various judgements especially the Jacob Mathew vs. State of Punjab 2005 and Anr, Martin F.D'Souza vs. Mohd. Ishfaq 2009, V. Kishan Rao vs. Nikhil Super Specialty Hospital 2010 delivered by the Apex Court to make the law of negligence more rational and directions given to subordinate Courts, various Consumer Fora, State and investigating agencies regarding procedures to be followed before filing a complaint or registering a case of criminal negligence against the doctor.

**Key words:** Medical negligence, doctor, patient, court judgement, laws

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### Introduction

The role of technology since the last fifty years is steadily increasing in the health care sector in India. So the clinician are relying more on technology in the field of diagnosis, management of the ailments and postoperative care. Moreover the patients are nowadays more demanding on account of more awareness of their rights. With the enactment of Consumer Bill doctors are now more cautious regarding the treatment of their patients thereby leading to the birth of defensive medicine and increasing the cost of treatment

which taxes the patients/relatives. Nowadays, if a patient is admitted in the hospital or visits the doctor for treatment of an ailment and due to treatment if any damage occurs to the patients, then the patients may go to police with the request for registering FIR under relevant section of IPC or file a complaint in the Court or Consumer Forum regarding inappropriate facilities, standard of professional competence and the appropriateness of therapeutic and diagnostic methods. Before the landmark judgement of Supreme Court of India in Jacob Mathew case, the cases of medical negligence were filed in the Courts/Consumer Fora without any subject

expert's opinion. But recently, this landmark judgement and the other judgements delivered by the Apex Court have made the law of medical negligence more rational to curb the filing of vexatious and frivolous complaints against the doctors

### **Negligence**

To define negligence is not easy. But in a simple terminology it can be said that it is breach of a legal duty to care. This failure of duty may be caused by the omission to do something which a reasonable person guided by those considerations which ordinarily regulate the conduct of human affairs should have done. It may also be doing something which a prudent and reasonable person would not have done. Basically, there are three constituents of negligence;

1) Legal duty to exercise due care on the part of party complained of towards the party complaining the former's conduct within the scope of duty.

2) Breach of the said duty and

3) Consequential damage

Cause of action for negligence arises when damage occurs, for, damage is a necessary ingredient of this tort. Thus the essential components of negligence are three 'duty', 'breach' and 'resulting damage' (1).

### **Civil negligence**

Persons who offer medical advice and treatment implicitly state that they have the requisite skill and knowledge to do so, that they have the skill to decide whether to take a case, to decide the treatment, and to administer the treatment. This is known as an "Implied undertaking" on the part of medical professional. In the case of State vs. Smt. Santra the Supreme Court held that every doctors "has a duty to act with reasonable degree of care and skill" (2). Doctors in India may be held liable for their services individually or vicariously unless they come within the the exceptions specified in the Indian medical Association vs. V P Santha i.e. if they do not charge fees (3). In a key decision in the case of Dr Laxman Balkrishna Joshi vs. Dr Trimbak Bapu Godbole, the Supreme Court held that if a doctor has adopted a practice that is considered "proper" by a reasonable body of medical professionals who are skilled in that particular field, he or she will not be held negligent only because something went wrong.(Bolam Test).The law expects an ordinary degree of skill from doctor (4). Doctor cannot give warranty of the perfection of their skill or guarantee of cure. If the right course of treatment has been adopted by doctor and is skilled and has worked with a method or

manner best suited to the patient, then he/she cannot be blamed for negligence even if the patient is not totally cured (5),(6),(7).

Certain conditions must be satisfied before liability can be considered. The person who is accused must have committed an act of omission or commission; this act must have been in breach of the person's duty; and this must have caused harm to the injured person. The complainant must prove the allegation against the doctor by citing the best evidence available in medical science and by presenting expert opinion (8).

In some situations the complainant can invoke the principle of Res Ipsa Loquitur or "the thing speaks for itself". In certain circumstances no proof of negligence is required beyond the accident itself. The maxim Res Ipsa Loquitur is only a rule of evidence. It might operate in the domain of civil law; but that by itself cannot be pressed into service for determining the liability for criminal negligence within the domain of criminal law. It has only a limited application in trial on a charge of criminal negligence

### **Criminal Negligence**

One of the essential elements in criminal is mens rea- the guilty mind or an evil intention. The question arises as to whether in cases of medical negligence- whether slight, ordinary or gross – is there any criminal liability. As mens rea is essential, it is difficult to argue that the doctor had a guilty mind and was negligent intentionally, this has been the main argument in most of the cases in which the decision was to regarding criminal liability.

In the Santra case, the Supreme Court has pointed out that liability in civil law is based upon the amount of damages occurred; in criminal law the amount and degree of negligence is a factor in determining liability. However, certain elements must be established to determine criminal liability in any particular case, the motive of offence, the magnitude of offence and the character of the offender. In Poonam Verma vs. Ashwin Patel the Supreme Court distinguished between negligence, rashness and recklessness. A negligent person is one who inadvertently commits an act of omission and violates a positive duty. A person who is rash knows the consequences but foolishly thinks that that they will not occur as a result of his/her act. A reckless person knows the consequences but does not care whether or not they result from his/her act. Any conduct falling short of recklessness and

deliberate wrongdoing should not be the subject of criminal liability (9).

Thus a doctor cannot be held criminally responsible for a patient's death unless it is shown that she /he was negligent or incompetent, with such disregard for the life and safety of his patient that it amounted to a crime against the State (10). The doctors may be prosecuted under various sections of IPC i.e .section 336, 337, 338, 304 A IPC. But the doctors are mostly prosecuted under section 304 A IPC. Defences for doctors accused of criminal liability rare imbided in the section 80 and 88 of the Indian Penal code. In Kanhaiya Kumar Singh vs. Park Medicare and Research Centre, it was held that negligence has to be established by complainant and cannot be presumed (11). In Suresh Gupta's case in August 2004 the standard of negligence that had to be proved to fix a doctor's or surgeon's criminal liability was set at 'gross negligence or 'recklessness". In this case the Supreme Court distinguished between an error of judgement and culpable negligence. It held that criminal prosecution of doctors without adequate medical opinion pointing to their guilt would do a great disservice to the community. A doctor cannot be tried for culpable or criminal negligence in all cases of medical mishaps or misfortunes.

Hence the complaint against the doctor must show negligence or rashness of such a degree as to indicate a mental state that can be described as totally apathetic towards the patient. Such gross negligence alone is punishable. The Court observed that allegations of rashness or negligence are often raised against doctor by persons without adequate knowledge, to extract unjust compensation. This results in serious embarrassment to doctors who are forced to seek bail to escape arrest. If bail is not granted then they face incarceration. Though they may be exonerated of the charges at the end; but in the meantime they would have suffered a loss of reputation; often irreversible. The tendency to initiate such cases has therefore to be curbed.

Since the medical profession renders a noble service, it must be shielded from frivolous complaints or unjust prosecution. With this perspective in mind the Court went into the question as to what actionable negligence in the case of professional. The law now laid down is as follows:

A simple lack of care, an error of judgement or an accident, even fatal will not amount to culpable medical negligence. If the doctor had followed a

practice acceptable to the medical profession at the relevant time, he or she cannot be held liable for negligence merely because a better alternative course or method of treatment was available, or simply because a more skilled doctor would not have chosen to follow or resort to that practice.

Professionals may certainly be held liable for negligence if they were not possessed of the requisite skill which they claimed, or if they did not exercise, with reasonable competence, the skill which they did possess.

The word 'gross' has not been used in section 304A IPC. However, as far as professionals are concerned, it is to be read into it so as to insist on proof of gross negligence for a finding of guilt (12).

In the case of Jacob Mathew vs. State of Punjab and Anr the issue of gross negligence was decided by Supreme Court (13).

The court directed the central government to frame guidelines to save doctors from unnecessary harassment and undue pressure in performing their duties. It ruled that until the government framed such guidelines, the following guidelines would prevail: A private complaint of rashness or negligence against a doctor may not be entertained without prima facie evidence in the form of a credible opinion of another competent doctor supporting the charge. In addition, the investigating officer should give an independent opinion, preferably of a government doctor. Finally, a doctor may be arrested only if the investigating officer believes that she/ he would not be available for prosecution unless arrested.

The Supreme Court in Martin F.D'Souza vs. Mohd. Ishfaq 2009 has delivered a judgement that whenever a complaint is received against a doctor or hospital by the Consumer Fora (whether District, State or National) or by the Criminal Court then before issuing notice to the doctor or hospital against whom the complaint was made , the Consumer Fora or Criminal Court should first refer the matter to a competent doctor or committee of doctors, specialized in the field relating to which the medical negligence is attributed and only after that doctor or committee reports that there is prima facie case of medical negligence should notice be then issued to the concerned doctor/hospital. This is necessary to avoid harassment to doctors who may not be ultimately found to be negligent. The Apex Court has further warn the police official not to arrest or harass doctors unless the facts clearly come within

the parameters laid down in Jacob Mathew's case (vide supra), otherwise the police man will themselves have to face legal action (14).

In V. Kishan Rao vs. Nikhil Super Specialty Hospital 2010, the Hon'ble Supreme Court had upheld the findings and decisions of District consumer forum on the basis of the lack of independent expert opinion (in the favour of complainant) relying on the principle of "Res Ipsa Loquitur"(meaning thereby the thing speaks for itself i.e. there is no need of expert opinion in every case of negligence) (15).

Medical council of India in compliance of the Supreme Court Judgement in the case of Criminal Appeal No. 144-145 of 2004 of Jacob Mathew vs. State of Punjab and Another has formulated guidelines for prosecution of medical professional under criminal law for their medical negligence (16).

#### **Conclusion**

Though the above cited judgements are rational and will remove the unfounded fear of medical negligence from the mind of honest and sincere professionals as the courts considers that medical profession renders a noble service to the society and it should be shielded from unjust prosecution. But the law does not give any immunity to the wrong doers. Either there may be negligence of the doctor, of hospital staff or of both. In most of the cases, it will be a case of joint and several liabilities. The division of liability between the two of them will be decided according to the understanding between two. As far as determining of negligence is considered, the courts may seek the opinion of subject experts alongwith the examination of the hospital /treatment record of the patient except in cases where things speaks for itself (Res Ipsa Loquitur).

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**Bio-medical waste- threat to environment:  
Management, disposal, ethical aspects and legal implications**

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**Citation:** Panzoo QR, Sandhu R, Sandhu SS, Singh P. Bio-medical waste-threat to environment: Management, disposal, ethical aspects and legal implications. *Int J Eth Trauma Victimology* 2016; 2(1):48-52. doi: 10.18099/ijetv.v2i1.11135

**Article history**

Received: March 28, 2016  
Received in revised form: June 01, 2016  
Accepted: July 5, 2016  
Available online: July 25, 2016

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**Abstract**

The world health organization [WHO] in 1983 discussed bio-medical waste issue. The seriousness of improper biomedical waste management was brought to the limelight during the “beach wash-ups” during summer 1998; which was investigated by the Environment Protection Agency (EPA) of the USA; and it resulted in the passing of Medical waste tracking Act (MwTA) in November 1998. This made USA the pioneer as far as waste management is concerned (1). Most important regarding the bio-medical waste is health hazards to patient and relatives, microbiological and chemical contamination of soil and ground water (2). Every human being should live in a clean environment is one of the Fundamental Rights, and is the innovative judicial interpretations of article 21 of Constitution of India. Article 48-A and 51 of the Constitution provide to protect and improve the natural environment including forests lakes, rivers and wild life. There are number of statutes like The Water Act, The Air Act, The Environment Protection Act, Hazardous Waste (management and Handling) Rules 1980. Forests Act, the Wild Life Acts and Provision of Indian Penal court, Criminal Procedure Code and Factories Act are meant for providing pollution free environment to mankind. There are many categories of institutions which pollute the environment but recently the ignored field which produce the pollution by way of Bio-Medical waste have attracted the attention of the environmentalists are the Hospitals, Dispensaries, Medical Shops, Medical clinics of doctors and other paramedical staff (3).

**Keywords:** Bio-Medical Waste, management, disposal Incineration, environment pollution ethics.

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**Introduction**

Waste material produced, during treatment, diagnosis immunization of human being or in research activities pertaining to or in the production or testing or biological” and including categories mentioned in Scheduled 1. The

government of India (notification 1998) specifies that Hospital Waste Management is a part of hospital hygiene and maintenance activities, known as bio-medical waste. This involves management of range of activities, which are mainly engineering functions, such as collection,

transportation, operation or treatment of processing systems, and disposal of wastes. A WHO study has shown that, of the total biomedical waste, about 85 percent is non-infectious, 10 percent is infectious but non-hazardous and rest 5 percent is both infectious as well as hazardous in nature (CPCB, 2000). Bio-medical waste is not only hazardous and pollute the environment but dangerous of human beings, animals and plants by other ways also. Every day the country's numerous hospitals and other medical institutions churn out millions of tons of waste. The total quantity of bio-medical waste for U.P is estimated at 20.7 MT per day. District wise biomedical waste generation potential is estimated based on the number of hospital beds. An alarming percentage of the waste lies on open space creating environmental problems. These can damage the environment, even at low concentration. Hence it is necessary to take precautionary measures, so that hazardous components in the waste are rendered harmless through proper treatment and safe disposal methods. Hospitals produce waste, which is increasing over the years in its amount and type. The hospital waste, in addition to the risk for patients and personnel who handle them also poses a threat to public health and environment. The major sources of biomedical waste production are Medical colleges and research centers, government hospitals, private hospitals, nursing homes, veterinary colleges and animal research centers, blood banks and autopsy centers. The minor sources are physicians clinics, animal houses, slaughter houses, blood donation camps and vaccination centers (4).

#### **Observation**

Bio-medical waste is very broad and wide problem especially of cities. The problem of bio-medical waste has acquired gigantic. About one and half kg of waste is produced per head/per day of the total hospital waste. If we take an example of a patient lying in the hospital for treatment and a normal man lives in the society, a patient in the hospital needs more and more hygienic and pollution free environment. He needs fresh oxygen. But the environment of the Hospitals especially of government hospitals is so polluted by the medical wastes that it becomes very difficult even for a normal man to go in the hospital to attend the patient. Recycling of the hospital waste is a big threat to the society. Workers in the hospitals regularly collect syringes drips and bottles, which they sell in the market. They also sell used and contaminated cotton and cotton like material to make mattresses etc.

Various items like blood, urine, sperms, stool, used cotton, disordered medicine chemicals, body organs like placenta, empty bottles, polythene bags of urine and blood, pipes, syringes waste of fruits etc. contribute to the pollution of environment: bio-medical waste shall be treated and disposed of in accordance with Schedule I and in compliance with the standards prescribed in Schedule V.

Every occupier, where required, shall set up in accordance with the time-schedule in Schedule VI, requisite bio-medical waste treatment facilities like incinerator, autoclave, microwave system for the treatment of waste, or, ensure requisite treatment of waste at a common waste treatment facility of any other waste treatment facility (5).

- Throwing it in the sewerage
- Throwing in a small trench, in case of body organs
- Burning, in very few cases
- Throwing on own or municipal corporation land, marked for the purpose
- Incineration (once or twice in six months in one government hospital
- Do not dispose, only dogs, cats and pigs carry all the wastes

About the use of incinerators, authorities always show their inability due to the costly process, lack of training, that all the private hospitals cannot afford incinerators, etc. It is true that no training is given to the operating staff about the disposal of bio-medical waste regarding incinerator. Sometimes incinerators do not give required temperature to burn the waste.

It is observed that the use of incinerator to dispose the medical waste is compulsory, but it is in the access of very few government hospitals due to its cost. In these days the trend of general public is to prefer private hospital than the government. So problem regarding the disposal of bio-medical waste is more with private hospitals than government hospitals but they do not have access to incinerator installed by the government (5).

#### **Discussion**

Bio-medical waste is a huge problem to overcome. Ministry of Environment and Forests has framed the Bio-medical waste (Management and Handling) Rules 1995, the waste is categorized into 10 types as shown in table 1.

In March 1996, the Supreme Court had ordered all hospitals to install incinerators or alternative

technologies to disinfect medical wastes. In technology of incineration for all hospital wastes, which release dangerous substances such as dioxins and furans.

implementing the orders, hospitals used the single

**Table1:** Showing different types of wastes

Category	Waste	Category	Waste
1.	Human anatomical waste, blood and body fluids	6.	Solid wastes
2.	Animal and slaughter house waste	7.	Disposables
3.	Microbiology and biotechnology waste	8.	Liquid wastes
4.	Waste sharps	9.	Incinerator ash
5.	Discarded medicines	10.	Chemical waste

The new rules focus on engineering issues, appropriate to the requirement of waste. They call for simplified “four-colour” scheme for segregation of waste and specification of how various kind of waste should be dealt with. These four colors are Yellow colour, Red colour, Blue colour/White translucent and Black colour.

All biomedical waste except chlorinated plastics and radioactive waste may be subjected to incineration (6). Use of chlorinated plastic bags for handling of bio-medical waste shall be prohibited and the occupier or operator of a common bio-medical waste treatment facility shall not dispose of such plastics by incineration.

**Table 2:** Treatment options for different types of wastes

Colour coding	Type of containers	Waste Category	Treatment Options as per Schedule I
Yellow	Plastic bag	1,2,3, 6	Incineration/deep burial
Red	Disinfected Contain er Plastic bag	3,6,7	Autoclaving/Microwa ving/ Chemical treatment
Blue/ White translucent	Plastic bag/puncture proof contain er	4,7	Autoclaving/Microwa ving/Chemical treatment and destruction/shreddin g
Black	Plastic bag	5,9,10 (Solid )	Disposal in secured landfill

**Transport and Disposal of Waste**

General waste – can join the municipal waste stream

For others, methods may be employed:

1. Incineration
2. Deep burial
3. Autoclave or microwave
4. Chemical disinfection
5. Shredding/mutilation/cutting

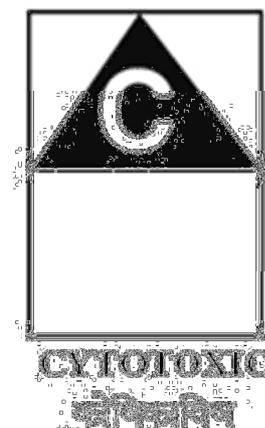
**BIOHAZARD SYMBOL**



**BIOHAZARD**

**Fig. 1:** Label for bio-medical waste containers/bags

**CYTOTOXIC HAZARD SYMBOL**  
कोषिकाविष परिसंकट चिन्ह



**Fig. 2:** Label for cytotoxic waste containers/bags

In the event of breakage of mercury containing medical instruments, necessary precautions shall be taken by the occupier to segregate such waste to the extent possible and also for its proper collection, storage and disposal as per rules and the guidelines issued by the Central Government or as the case may be, the Central Pollution Control Board in order to avoid of minimize mercury releases into the environment (7).

### **Ethical aspects**

Ethical aspect related to social responsibilities. The health professionals have, as a result of their status, knowledge and skills and an obligation to alert those who are at risk. This is reflected by compulsory notification of infectious and notifiable diseases as a measure of public welfare.

There are many examples and ample evidences that indiscriminate management of bio-medical waste could cause serious hazards to health and environment as follows:

There are many harmful agents in the bio-medical waste. The most important are biological agents, which pollute water and food and cause alimentary infections like Cholera, Typhoid, dysentery, infective hepatitis, polio and ascariasis and hookworm diseases, etc.

### **Legal implications**

As per law, it is mandatory for all types of medical service providers to ensure proper implementation of Bio-medical waste (Management and Handling) Rules, 1998. Installation of incinerator is mandatory for hospitals with more than 50 beds.

It may be kept in mind that any person can report any alleged negligence in management and handling of bio-medical waste to the appropriate authority. The state pollution control board/committees have been asked to take action against the defaulting hospitals or nursing homes under Section 15 (1) of the Environment (protection) Act, 1996, which reads as "Whoever fails to comply with or contravenes any of this act, or the rules made or orders or directions issued hereunder, shall, in respect of each such failure or contravention, be punishable with imprisonment for a term, which may extend to 5 years or with fine which may extend to one lakh rupees or which

- Colors due to their hazardous nature.
- Bio-medical waste management Board can be established in each District.
- Either judicial power should be given to the management board or special court should be established in the matters of

both, and in case of failure or contravention continues, with additional fine, which can extend to five thousand rupees for every day during which such failure or contravention continues after the conviction for the first such failure or contravention.

Any person aggrieved by an order made by the prescribed authority under these rules may, within a period of thirty days from the date on which the order is communicated to him, prefer an appeal in Form VI to the Secretary (Environment) of the State Government or Union territory administration (8).

### **Suggestions:**

- For the use of incinerator, training should be given to concerned persons from medical staff.
- Bio-medical waste management is needed due to health, environment, legal & aesthetic reasons in additions to ethical reasons.
- Specific funds should be allocated for the use of incinerator
- Every hospital should have special boxes to use as dustbin for bio-medical waste
- Bio-medical waste should not be mixed with other waste of Municipal Corporation
- Private hospitals should also be allowed to use incinerator, which is installed, in government hospital. For this purpose specific fee can be charged from private hospitals.
- Special vehicle i.e. bio-medical waste vehicle should be started to collect waste from private hospitals and private medical clinics and carry it up to the main incinerator.
- As provided by bio-medical waste rules, the whole of the waste should be fragmented into

environment pollution for imposing fines and awarding damages etc.

- NGOs should actively come forward to curb the problem
- Regular courses on waste management for nurses should be introduced.

- Minimize the generation of bio-medical waste (7).

priority, then the upcoming generations will see its effects leading to ill health of living beings. Therefore bio-medical waste management is essential to save environment, plantations, human and animal life.

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#### Conclusion

It is concluded that bio-medical waste management is the need of hour, if it is not given

## Lesch–Nyhan Syndrome: In a Yemani female child

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**Citation:** Swaminarayan Y, Gorea RK, Gorea A, Khan MS, Mustafa G. Lesch-Nyhan Syndrome: Ina Yemini female child. *Int J Eth Trauma Victimology* 2016; 2(1):54-57. doi: 10.18099/ijetv.v2i1.11136

### Article history

Received: March 25, 2016

Received in revised form: June 11, 2016

Accepted: June 25, 2016

Available online: July 25, 2016

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### Abstract

Lesch–Nyhan syndrome usually affects young children in which there is a compulsive tendency of self-mutilation. There are learning difficulties along with and involuntary movements. In this case there was mental retardation along with osteomyelitis of the left big toe. It is a hereditary disorder and affecting mostly male children but this is a rare case affecting a female child.

**Keywords:** Lesch–Nyhan syndrome, osteomyelitis, fractures, behavioral disorder

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### Introduction

Lesch–Nyhan syndrome is said to be a disease showing neurological and behavioral disorders. Head banging and biting is a common manifestation in this disease (1). Chewing of lips and fingertips is also common, causing self-mutilation. Mechanism of production of these symptoms is not known till date (2). It is also known as Lesh-Nyhan disease, hypoxanthine-guanine phosphoribosyl transferase deficiency, HGPRT deficiency and HPRT deficiency (3).

In this disorder Purine metabolism is affected due to lack of an enzyme called hypoxanthine guanine phosphoribosyl transferase 1 (HPRT\_1) (2) and simultaneously there is increased production of uric acid and this causes gouty arthritis (1). Biopsy of skin may reveal a decreased level of HGP enzyme (2). Nephro-calcinosis and renal failure has also been reported in patients suffering from this syndrome (4).

It is an inherited disorder linked with the X chromosome and affecting mostly males (2).

Hypoxanthine-guanine phosphoribosyl transferase (HGprt) assay strongly correlates to six biomarkers (AICAR mono- and tri-phosphate, nicotinamide, nicotinic acid, ATP and Succinyl-AMP) in red blood cells, is an effective for diagnosing Lesch–Nyhan Syndrome (5).

Prenatal gene mutation diagnosis of HPRT1 for causing Lesch–Nyhan Syndrome is accurate and helpful to prevent the birth of a baby suffering from Lesch–Nyhan Syndrome (6).

Accurate carrier detection by molecular diagnosis for genetic heterogeneity of HPRT1 gene which causes HGprt deficiency so that genetic counselling can be provided in time (7).

### Case report

There was a 3 years Yemani female child with a history of pain and swelling of big toe since 15 days. There was a previous history of pain and swelling of

big toe which subsided with conservative treatment about 3 months back. In Jordan she had been diagnosed with Lesch–Nyhan syndrome.

On examination she was mildly mentally retarded and her facial features supported the diagnosis. Her incisors teeth had been removed to prevent mutilation of her own body parts by herself. Facial grimacing and repetitive movements of her arms and legs, similar to those seen in Huntington's chorea, were present.



**Fig. 1:** Showing collection of pus and swelling and redness around big toe

WBC count and ESR was raised. She had hyper uric acid levels for which she had been given allopurinol and levels came to normal after treatment. X ray shows osteomyelitis of the proximal phalanx of big

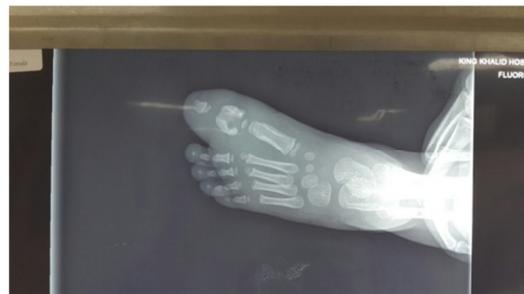
toe. MRSA methicillin resistant staph aureus growth was seen on culture on the sample taken during operation.



**Fig. 2:** Incision in the swelling showing bony changes of osteomyelitis and granulation tissue during surgery



**Fig. 3:** X-ray image showing osteomyelitic changes in the proximal phalanx of big toe



**Fig. 4:** X-ray image showing osteomyelitic changes in the proximal phalanx of big toe

### Conclusion

Lesch–Nyhan syndrome was seen in a young female child showing mental retardation and osteomyelitis with raised WBC and ESR. Uric acid levels were raised which came down with treatment. The condition also improved by treatment with

allopurinol in an Indian child suffering from same disease (8). This case has been presented so that people can be aware of this rare disorder in a female child, which usually affects males, so that prenatal diagnosis of this syndrome should be made even in pregnancy with girl fetuses to prevent the birth of girls suffering from this syndrome. This is rare presentation affecting a female child.

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## Letters to Editor

Sinha PK. Letter to editor. Int J Eth Trauma  
Victimology 2016; 2(1):56. doi:  
10.18099/ijetv.v2i1.11138

Dear Sir

Please find my views about one of the papers  
published in your journal.

**Name of authors:** Gover M, Balamurugan A, Bhavya  
T, Poturaju V, Puri PM.

**Title of article:** Odontometric study analysis of  
mandibular canine teeth to establish sexual  
dimorphism in North Indian population

**Statement of the problem or issue discussed:** Sexual  
dimorphism using canine teeth not discussed with  
any additional new perspective or study design.

**Is the title of the article appropriate and clear:** Title  
mislead to the fact that large number of sample size  
is included from different regions or states of North  
India.

**Abstract:** The abstract is specific, representative of  
the article, and in the correct form but fails to stir  
the inquisitiveness in readers.

**Introduction:** the purpose of the article made clear  
in the introduction.

**Methodology:** Study sample size is less to  
confidently use term North Indian population.  
Sample size could have increased including more  
people from different regions or states of North  
India. Also these populations could have been then  
classified and represented according to their specific  
origin to make research work sturdier. Being aware  
of the fact that study is repetitive attempt of several  
such studies done in past the difference could be  
made with sample size and statistics used.

**Errors of fact and interpretation:** It's remorseful  
affair that authors have tried to extrapolate  
statistical analysis from tiny sample to the whole

population. Neither the samples collected appears to  
be random. Henceforth could be probability that  
there can be correlation between the 80 people  
selected. Nor statistical analysis is extensive to  
substantiate there study results. There is no  
sufficient data to support the author's  
generalizations.

**Discussion:** The authors sum the study by  
overemphasizing the proven facts by other  
researchers. But manuscript is ineffective as it fails  
to expand the obtained results in more analytical  
manner.

Furthermore, authors in discussion clearly mention  
there obtained result is from Gujarati population  
that consequently contradicts title & methodology.

Generally this article is not very impressive  
as it gives no new information, sexual dimorphism  
using canine had been done repetitively from years.  
In order to have more readers engaged and read the  
whole article it needs a new and more concise  
methodology to make it different from studies done  
in past. Highlight more sample size, diverse study  
population and considering different inclusion  
criteria's.

Overall it is well written article the data and  
conclusions do not contradict each other. With an  
important message for all medical, dental examiners  
and police that in unidentified deceased individual's  
canine teeth, if in good condition can be definitely  
used as it economical and easy to analyse. Although  
the study has limitations of sample size and  
inadequate statistical analysis but this piece of  
research when taken as a whole is relevant and  
convincing.

Definitely if more study population and substantial  
statistics are used this research work can do  
contribution in the advancement of knowledge,  
theory, or practice in future.

**Dr Parul Khare Sinha**

MDS, Masters Forensic Odontology  
Assistant professor  
Department of Oral Pathology  
Jiao Tong University  
Shanghai, China.

## Instructions to authors

### Preparing a Manuscript for Submission to International Journal of Ethics, Trauma and Victimology

Unpublished original manuscript written in English should be sent to:

Dr. RK Gorea, Editor, International Journal of Ethics, Trauma & Victimology by email at editoretv@gmail.com

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The IJETV is the publication supported by SPIC, published since 2015.

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The journal accepts a range of articles of interest, under several feature sections as follows:

- Original Papers: Includes conventional observational and experimental research.
- Commentary: Intended for Reviews, Case Reports, Preliminary Report and Scientific Correspondences.

### Letter to the Editor

Designed to be an avenue for dialogue between the authors of the papers published in the journal and the readers restricted to the options expressing reviews, criticisms etc. It could also publish letters on behalf of the current affairs in the field of Ethics, Trauma & Victimology

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Intended as a platform, for the Editor-in-Chief and for others with a keen interest in Ethics, Trauma & Victimology that wished to comment on the current affairs.

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