

# Oral Autopsy – Dental Surgeon’s Perspective

Sriraman Rajkumari<sup>1\*</sup>, Radhakrishnan Mensudar<sup>2</sup>, Balakrishnan Thayumanavan<sup>3</sup> and Palaniappan Tamilselvi<sup>4</sup>

<sup>1</sup>Research Scholar, Bharath Institute of Higher Education and Research, Chennai – 600073, Tamil Nadu, India; dr.rajkumari@yahoo.com

<sup>2</sup>Department of Conservative and Endodontics, Sree Balaji Dental College and Hospital, Chennai – 600100, Tamil Nadu, India

<sup>3</sup>Department of Oral Pathology and Microbiology, Sathyabama Dental College and Hospital, Chennai – 600119, Tamil Nadu, India

<sup>4</sup>Department of Anatomy, Sathyabama Dental College and Hospital, Chennai – 600119, Tamil Nadu, India

## Abstract

**Background:** Autopsy is routinely performed by the coroner in all medico-legal cases but the dental expertise is rarely sought. However, oral autopsy involving careful visual examination, imaging and laboratory methods can aid in solving the enigma associated with legal aspects of crime scene and death investigation. **Aim:** To illustrate the importance of oral autopsy during routine post-mortem examination. **Data Sources:** Pub-Med, Google Scholar search engines were used to extract the data. **Conclusion:** Oral autopsy performed as an adjuvant to regular autopsy procedure will definitely benefit in the legal investigation related to visually identifiable, decomposed, burnt or skeletonized corpse.

**Keywords:** Forensic Odontology, Jaw Dissection, Oral Autopsy, Virtopsy

**Article chronicle:** Date of Submission: 10.03.2019; Date of Acceptance: 18.12.2019; Date of Publication: 24.04.2020

## Introduction

Francois Xavier Bichat – the founder of histology, dictates “Dissect in anatomy, experiment in physiology and make necropsy in medicine; this is the threefold path without which there can be no anatomist, no pathologist, no physician” and hence all un-natural and suspicious cases must be subjected to autopsy. The word autopsy (synonym – post-mortem) was derived from the Greek term *avtousia* (*autopsia*) *autos* means self and *opsis* means to look at. Autopsy had evolved over a period of time - it started as a procedure to evaluate professional conduct; later it was reached to sort out the suspicion related to the nature of death, then autopsy was sought to demonstrate and practice excision, incision, suturing, needling; autopsied tissues also served to conduct various laboratory studies such as histochemistry, immunochemistry, microbiology, electron microscopic studies; currently the autopsied tissues serve as a warehouse of transplant in treating the living<sup>1</sup>.

Autopsy usually involves systematic examination of external and internal organs of the corpse by specifically dissecting the visceral organs. Oral cavity similar to other body parts is made of complex organ tissues such as glandular structures (salivary gland), specialized mucosa (tongue), keratinized, non-keratinized mucosa and dental, hard and soft tissues (enamel, dentin, cementum and pulp) provides a reliable source of post-mortem information. Hence oral autopsy can be defined as “examination of the oral and para-oral structures including the dental apparatus in a dead irrespective of the integrity of the tissues to reveal the identity of the unknown, which involves visual, radiographic and laboratory investigation by an expert dental surgeon.”

Oral autopsy can be applied at various stages of post-mortem, 1. Visually identifiable body, 2. Decomposed/incinerated/traumatized body, 3. Skeletonized remains. Though an intact body may not require dental information for its identity, certain circumstances of death, (fire, trauma, disintegration, etc.) and post-mortem taphonomic

\*Author for correspondence

effects, (decomposition, mummification, saponification, skeletonization, animal predation/scavenging, insect activity, etc.) may deem the need for oral findings<sup>2</sup>.

## Objectives to be Followed during the Oral Autopsy Procedure<sup>2-4</sup>

When the identity of the corpse is known the following procedures must be implied:

- Informed written consent from the investigating personnel and from the family members must be obtained.
- Obtain personal information and photographs related to the deceased from the family members.
- Obtain ante-mortem and post-mortem dental, medical records from the respective family dentist or physician.

If the identity of the corpse is unknown and distorted then photographs, radiographs (extraoral and intraoral) must be made prior to autopsy.

Comparative dental identification involving comparison of intraoral examination records with ante-mortem dental records can effectively conclude the identity of unknown individual<sup>5</sup> while investigation involving defragmented body requires reconstructive identification procedure. Whatever is the profiling method, two sets of all documents including the radiographs must be made by the expert, one for the medical reporting another one for the forensic odontologist<sup>2</sup>.

## Oral Autopsy Procedure

Oral autopsy involves extraoral and intraoral examination. Extraoral observation must include facial asymmetry, lacerations, any pathology and change in color of the skin or lips<sup>6</sup>, while intraoral examination involves evaluation of hard and soft tissues of the oral cavity. Hard tissue examination comprise of dental charting, identification of dental restorations, implants, dentures or any other artificial material on the teeth and associated structures, fracture of bone or teeth, while soft tissues must be looked upon for any wrinkling, dryness, peeling, hematoma, laceration, developmental anomalies, pathological changes or lesions on the oral mucosa<sup>7</sup>. UV light assisted examination of dental hard tissues helps in recognition of various types of restorative materials<sup>8</sup>.

In a well preserved corpse, intraoral access becomes difficult with the commencement of rigor mortis that proceeds, after the death of an individual. In such a situation mouth gags, trismus screws and intraoral myotomy can be performed, usually followed by extraoral facial or infra-mandibular dissection<sup>9,10</sup>.

The extra-oral facial incision (Figure 1A) is made from the angle of the mouth to the anterior border of the ramus, which allows better access to the underlying oral soft and hard tissues. This type of incision was done routinely in olden days but now it is implied on decomposed or burned corpse where soft-tissue is desiccated. The infra-mandibular incision (Figure 1B) is done in visually identifiable corpse specifically to maintain facial esthetics. Here bilateral incisions are made posterior and inferior to the ears which run across the anterior part of the neck through the midline to points posterior and inferior to ears. The skin and underlying tissues are then reflected upward over the lower face thereby exposing the mandible (Figure 1C)<sup>2,9-11</sup>.

Fereira *et al.*, (1997)<sup>9,10</sup> proposed a technique (Figure 1D) to assess the oral cavity by making a rectangular incision where the superior incision extends on the mid-face over the anterior nasal spine to the tragus of the ear on either side, while the inferior incision runs over the mental eminence below the alveolar process of the mandible extending up to the ramus. The two lateral incisions join the superior and the inferior incisions. Lip, cheek and other muscles are separated along the periosteum. He insisted on maintaining photographic record at every stage of incision to achieve appropriate repositioning.

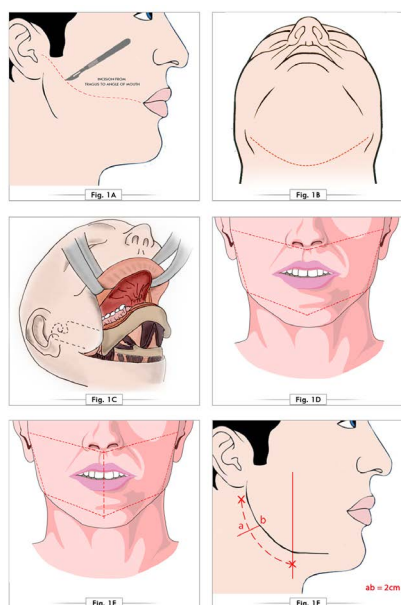
Silver and Souviron (2009) applied modified extraoral facial incision (Figure 1E) where they made bilateral horizontal incision extending from the commissure of the lips to the tragus with an additional midline vertical incision parting the horizontal incision over the lips<sup>12</sup>.

Heit OF *et al.*, (2014)<sup>12</sup> made bilateral “C-shaped” incisions of approximately 6 cm in adults in the retromandibular region, one centimeter below the ear lobe extending upto the virtual vertical line from the anterior border of the mandibular ramus. The incision is placed at two centimetres away from the posterior border of the mandible (Figure 1F). The deeper layers of the medial pterygoid and masseter muscles along with their tendons are dissected near the angle of the mandible followed by linear osteotomy on the ramus thereby facilitating the

separation of the mandible body which helps in better intraoral access.

Rigor mortis in infants causes less stiffness compared to adults, so intraoral access is seldom difficult, hence Aka and Canturk (2014) implied curved incisions on the crest of the alveolar ridges of both maxilla and mandible followed by elevation of periosteum and removal of the tooth germ using elevator. The tooth germs as well as unerupted teeth are immediately transferred to 10% formalin solution or 1% phenol or 10% sodium hypochlorite for fixation and preservation, which can be later examined to conclude the stage of tooth development, while the characteristics of all the erupted teeth are noted on the dental chart<sup>4</sup>.

Once the incision is made, the jaws are resected for further investigation, apices of the teeth in both maxilla as well as mandible have to be preserved during resection. The resection can be done by any one of the following methods<sup>2,7,9,10</sup>.

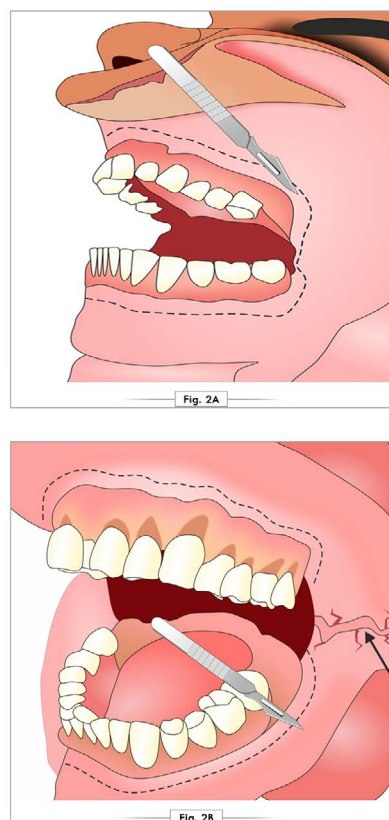


**Figure 1:** Various types of extra oral incision (A) Extraoral facial incision, (B) Infra mandibular incision, (C) Reflection of the flap, (D) Rectangular incision, (E) Modified extraoral facial incision, (F) C-shaped incision.

### Stryker Autopsy Saw Method

After the superficial incisions are made, the soft tissue and muscle attachments on the lateral as well as medial aspect of the mandible are dissected by deeper incisions. The incisions extend through the muco-buccal fold to

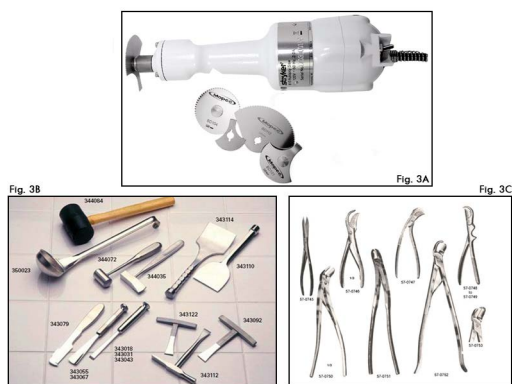
the lower border of the mandible on the facial aspect including masseter attachment while on the lingual aspect the pterygoid attachments are dissected through. In maxilla on the facial aspect the incision is made high up to the malar processes above the anterior nasal spine (Figure 2A)<sup>3</sup>. Once the bone is exposed, separation of mandible can be done by using stryker saw where cuts are made on the ramus in such a way that the impacted third molars are preserved (Figure 2B)<sup>3</sup>. Mandible can also be removed by disarticulation of the temporomandibular joints. While in maxilla, bone is cut high on the malar processes above the anterior nasal spine to preserve the apices of maxillary teeth and the entire maxilla is separated using stryker saw. All the armamentarium used for cutting the bone is given in Figure 3<sup>13-15</sup>.



**Figure 2:** (A) Intraoral flap elevation, (B) Mandible resection at the level of ramus.

### Mallet and Chisel Method

In this method, a mallet and chisel are used to induce a “Le Fort” Type I fracture of the maxilla below the zygomatic arch and on either sides of the maxillary sinus walls



**Figure 3:** Resection armamentarium used for bone fracture (A) Stryker autopsy saw, (B) Mallet and chisel, (C) Pruning shears.

similar to the Stryker saw method. Here, disarticulation of the temporomandibular joint is only possible method to separate the mandible as the mallet and chisel cannot break through the ramus.

## Pruning Shears Method

In this method, large pruning shears are used to separate maxilla by applying backward pressure in the nares and cutting the maxilla superior to the apices of the maxillary teeth bilaterally. Mandibular ramus is cut near the coronoid notch bilaterally.

Oral autopsy procedure and its inference at various instances of death is given in Table 1 and Table 2 respectively.

**Table 1.** Steps involved in oral autopsy at various circumstances of death<sup>2</sup>

S.no	Type of corpse	Procedure involved in autopsy
1	Visually identifiable body	<ul style="list-style-type: none"> <li>• Extra oral/intra oral incision of masticatory muscles, with or without fracture of the condyles depending on the rigor.</li> <li>• Infra-mandibular dissection with or without mandibular resection.</li> <li>• Removal of the larynx and tongue at autopsy for better visualization of dentition and placement of intra oral films.</li> </ul>
2	Decomposed, Incinerated, or Fragmented Bodies	<ul style="list-style-type: none"> <li>• Sterilization of the tissue should be performed as a preliminary step in case of decomposed bodies.</li> <li>• Radiographs must be the primary step in incinerated fragments because it may turn into ashes on manipulation</li> <li>• Jaw resection is done in all of these cases if required.</li> </ul>
3	Skeletonized Remains	<ul style="list-style-type: none"> <li>• Skull and mandible would have already been separated which avoids the need for jaw resection.</li> </ul>

\* Jaw resection is mandatory in medico legal cases, hence the resected jaw has to be preserved.

## Adjuvant to Oral Autopsy Procedure

Visual and radiographic examination procedure requires the presence of victim as well as the coroner while some procedure involving crime investigation or personal identification involves elaboration of intricate details obtained from the site of incident. Most of these procedures involve computer-based software analysis, specialized equipment and sophisticated laboratory setup. The laboratory procedures that are routinely sought in forensic odontology include - cheiloscopy, rugoscopy, bitemark analysis, craniofacial superimposition, facial reconstruction, histological analysis and molecular analysis<sup>5</sup>.

## Recent Advances

Though the regular autopsy procedure is conservative, it involves mutilation of the body, which cause emotional agony to the victim's relatives<sup>16</sup>. Hence Thali *et al.*, from Institute of Forensic Medicine, University of Berne, Switzerland devised an alternative system by using virtual imaging techniques which include; Computerized Tomography, Magnetic Resonance Imaging and Cone Beam Computed tomography. The autopsy procedure done using virtual image is referred to virtopsy.

Virtopsy not only aids in age and gender assessment from virtual skeletons,<sup>17</sup> a Multislice Computerized Tomography can effectively substantiate choking or bolus

death,<sup>18</sup> analysis of lung volume may give clue of drowning also it can be successfully applied in thanatological investigations, mass disaster cases; anthropological examinations and skin lesion analyses<sup>16</sup>. Imaging techniques can accurately conclude the type of dental restorative material based on the radiodensity. Virtopsy is more effective in comparative dental identification<sup>19</sup> and superimposition techniques. The applicability of virtopsy at various medico-legal incidents is listed in Table 3<sup>20</sup>.

## Future Considerations

Forensic investigation involves dental expertise in personal identification as well as crime investigation wherein comparative or reconstructive protocol is followed. Forensic odontologists, are not only expertise in analysing the dental traits they can effectively work with mass disaster recovery team<sup>10</sup>. The vivid knowledge on anatomy, physiology and pathology of oral and para-oral structures that comprise hard and soft tissues houses

**Table 2.** Oro-facial manifestations under various circumstances of death<sup>6,9</sup>

Sno.	Cause of death	Orofacial manifestations
1.	Hanging, manual and ligature strangulation	Petechiae on the face, conjunctiva, larynx, oral mucosa, base of tongue and epiglottis, tongue protrusion between clenched teeth Conjunctival petechiae, facial, intraoral, laryngeal petechiae
2.	Smothering death	In edentulous (children and elderly people): no perioral or intraoral injuries In dentulous: trauma over face, chin, lip, tongue, buccal mucosa.
3.	Choking	Marks or injuries consistent with victim’s head being held may be observed and perioral and intraoral injuries can be seen. Inflammation and associated edema of the palate, tongue, uvula, epiglottis, larynx may result in obstruction of the upper airway tract. Individuals without teeth may have trouble chewing and aspirate into the airway
4.	Drowning	Froth is expressed around the mouth and nostrils
5.	Death from child abuse and neglect	Bruised or lacerated lips, gums, tongue, buccal mucosa, even scarring (in chronic abuse). Failure to provide dental care is another form of child abuse.
6.	Death due to seizures	Lip injuries and bite marks over tongue along with gingival hyperplasia due to prolonged intake of phenytoin.
7.	Shooting fatalities	Soot deposition on the lips, teeth or tongue, intraoral wounds and on the roof of the mouth. High-velocity wound to the mouth can lead to extensive fractures of the skull and tears around the nose, eyes, and mouth. Perioral “stretch” lacerations are limited to mouth entries
8.	Blunt and/or sharp force injuries	Vehicle accidents causing cranial bone and mandible fracture
9.	Suspicion of intoxication	Presence of burns in the mouth area or face; froth on lips in the case of cyanide poisoning
10.	Chemical Burns	Caustic agents such as alkaline, acidic and chlorine bleach in solid or solution form cause corrosive damage and burns to the tongue, lips, oral mucosa membrane and surrounding skin of the face.

**Table 3.** Virtopsy in various medicolegal incident<sup>5,20</sup>

S.No	Medicolegal incident	Virtopsy manifestations
1.	Traffic accidents	The axis and the impact force can be determined.
2.	Firearms	Bullet channel, the bullet’s entering and escape places can be ascertained; the order of fractures, type of ammunition, lesion’s depth and orientation can be established
3.	Burns	Direction of flames as well as the tissues’ carbonization degree are elucidated.
4.	Age estimation	Children/adolescence: Schour and massler’s method, Demirjian’s method, Third molar analysis Adult: Pulp tooth ratio



vital information about the deceased and hence oral autopsy should be made compulsory in regular autopsy procedure. The dental surgeon's expertise and proficiency may add upon to the investigative team in drawing quick positive results.

## References

1. Stenn F. Six hundred years of autopsies. *Laboratory Medicine*. 1971;2(1):21–5. <https://doi.org/10.1093/labmed/2.1.21>
2. American Board of Forensic Odontology (ABFO). *Body Identification Information and Guidelines Revise*. 2017 Feb.
3. Gowda BKC, Mohan CV, Hemavathi. Oral autopsy: A simple, faster procedure for total visualization of oral Cavity. *J Forensic Dent Sci*. 2016;8(2):103–7. PMID: 27555728 PMCID: PMC4970404. <https://doi.org/10.4103/0975-1475.186375>
4. Aka PS, Canturk N. Aka Canturk oral autopsy method for the dental identification of fetus and infant cases. *Forensic Med Anat Res*. 2014;2: 48–50. <https://doi.org/10.4236/fmar.2014.23009>
5. Shafer, Hine, Levy. *Forensic odontology*. Sivapathasundaram B, ed. *Shafer's Textbook of oral pathology*, 8th edn. New Delhi: Elsevier Publishers; 2016. p. 724–40.
6. Fonseca GM, Cantín M, Lucena J. Forensic dentistry as a morphological exercise in the medico-legal investigation of death. *Int J Morphol*. 2013;31(2):399–408. <https://doi.org/10.4067/S0717-95022013000200006>
7. Senn DR, Weems RA. *Manual of Forensic Odontology*. A publication of the American Society of Forensic Odontology. Fifth Edition. Taylor and Francis Group, LLC CRC Press. 2013. P. 76–125.
8. Nuzzolese E. Dental autopsy for the identification of missing persons. *J Forensic Dent Sci*. 2018;10:50–4. PMID: 30122870 PMCID: PMC6080158. [https://doi.org/10.4103/jfo.jfds\\_33\\_17](https://doi.org/10.4103/jfo.jfds_33_17)
9. Sharma D, Koshy G, Garg S, Sharma B, Grover S, Singh M. Oral autopsy, facial reconstruction and virtopsy: An update on endeavors to human identification. *RUHSc Journal of Health Sciences*. 2017;2(4):199–206. <https://doi.org/10.37821/ruhsjhs.2.4.2017.199-206>
10. Stavrianos C, Dietrich EM, Stavrianos I, Petalotis N. The role of dentistry in the management of mass disasters and bioterrorism. *Acta Stomatol Croat*. 2010;44(2):110–9.
11. Haribhakti VV. *Restoration, reconstruction and rehabilitation in head and neck cancer*. Springer. 2019. p. 8. <https://doi.org/10.1007/978-981-13-2736-0>
12. Heit OF, Silva RF, Franco A. Improving traditional dental autopsies in postmortem examinations of intraoral gunshot wounds. *J Forensic Legal Med*. 2014;23:87–90. PMID: 24661714. <https://doi.org/10.1016/j.jflm.2014.02.004>
13. <https://fragoimpex.com/surgical/thoracic%20and%20lung/thoracic%20lung%2057.htm>
14. <https://www.mopec.com/product/stryker-autopsy-saw/>
15. <https://fragoimpex.com/surgical/autopsy/autopsy.htm>
16. Junior AFDR, Souza PHC, Coudyzer W, Thevissen P, Willems G, Jacobs R. Virtual autopsy in forensic sciences and its applications in the forensic odontology. *Rev Odonto Cienc*. 2012;27(1):5–9. <https://doi.org/10.1590/S1980-65232012000100001>
17. Cooper SGC, Urlich-Bochsler S, Uldin T, Ross S, Oesterhelweg L, Bolliger S, Christe A, Schnyder P, Mangin P, Thali MJ. Estimation of sex and age of “virtual skeletons” - a feasibility study. *Eur Radiol*. 2009;19:419–29. PMID: 18766348. <https://doi.org/10.1007/s00330-008-1155-y>
18. Oesterhelweg L, Bolliger SA, Thali MJ, Ross S. Virtopsy postmortem imaging of laryngeal foreign bodies. *Arch Pathol Lab Med*. 2009;133:806–10. PMID: 19415958. <https://doi.org/10.5858/133.5.806>
19. Nagaraj T, Nigam H, Gogula S, Sumana CK, Biswas A. Virtopsy: An emerging tool. *J Adv Clin Res Insights*. 2018;5:38–40. <https://doi.org/10.15713/ins.jcri.205>
20. Perju-Dumbrava D, Anițan S, Siserman C, Fulga I, Opincaru I. Virtopsy - An alternative to the conventional autopsy. *Rom J Leg Med*. 2010;1:75–8. <https://doi.org/10.4323/rjlm.2010.75>

**How to cite this article:** Rajkumari S, Mensudar R, Thayumanavan B and Tamilselvi P. Oral Autopsy – Dental Surgeon's Perspective. *J Forensic Dent Sci* 2020;12(1):66-71.

### Access this article online

Website:

[www.jfds.org](http://www.jfds.org)

### Quick Response Code

