Characteristics of the number of odontoblasts in human dental pulp post-mortem

Seminar
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Introduction

- **Post-mortem interval**

- **Why tooth organ?**

- **What is the odontoblast?**

Introduction

- **Post-mortem interval**

  Identification

  Place of Death

  Timing of Death

  Cause of Death

  Manner of Death

Introduction

- **Post-mortem interval**

Early stage : Body temperature

Rigor mortis, Livor mortis
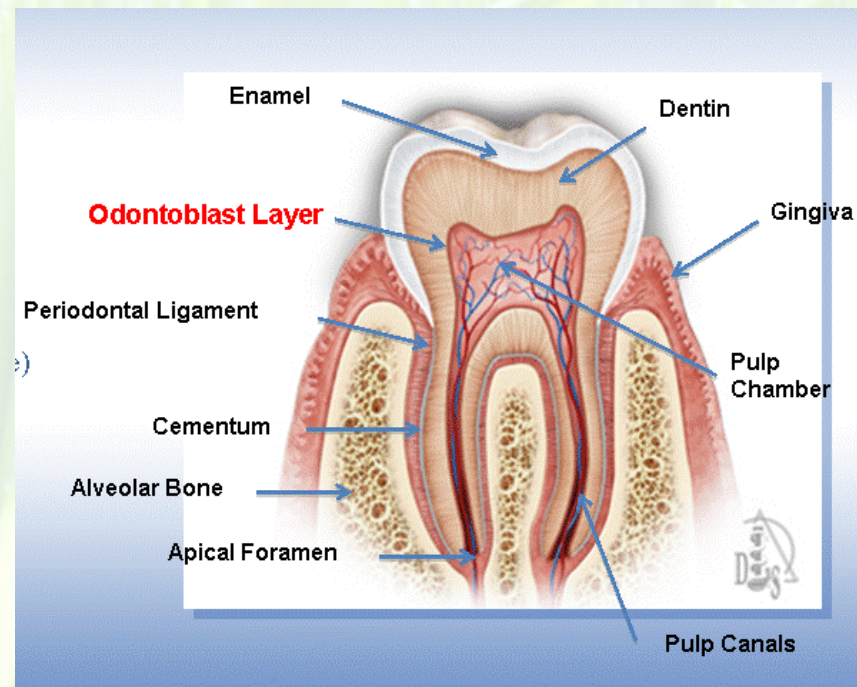
Gastric emptying

Eye changes

Late stage :   Decomposition

Forensic entomology

Introduction

- **Post-mortem interval**

 - **Why tooth organ?**

Odontoblast in Dental pulp

Introduction

- **Post-mortem interval**
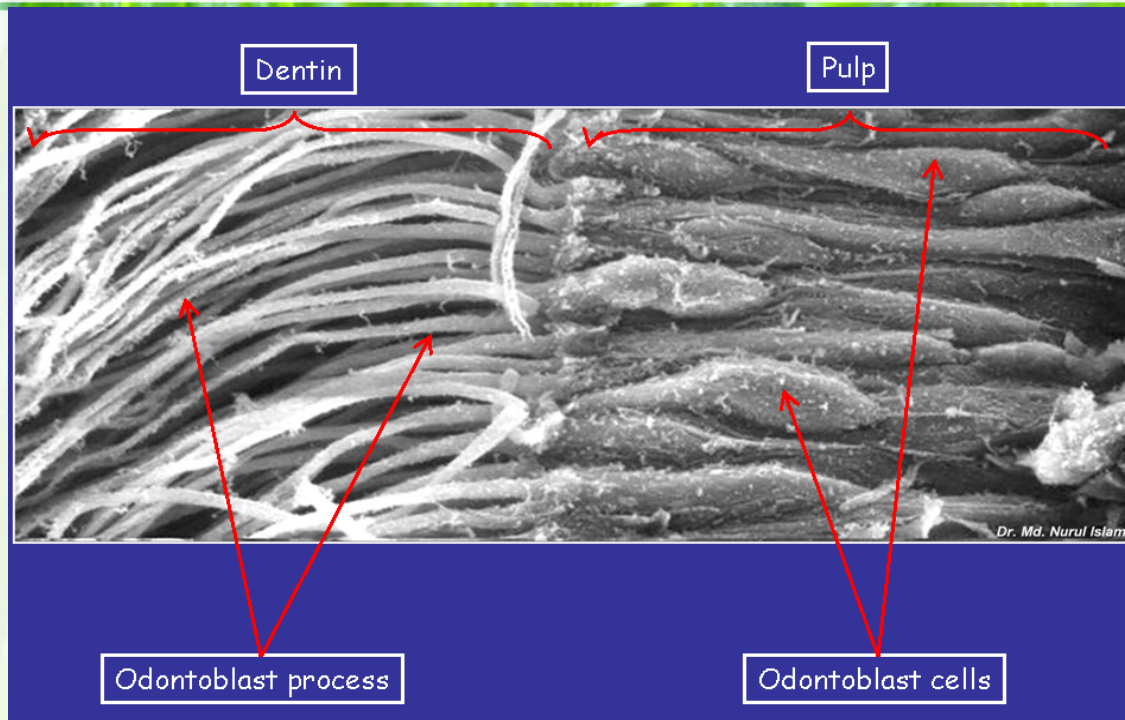
  - **Why tooth organ?**

- **What is the odontoblast?**

Introduction

* Columnar cells : outer surface of dental pulp

* Rich in ER, Golgi complex , Mt.,RNA

- **What is the odontoblast?**
→ Protein secreting cell

* Function : Dentinogenesis

Odontoblasts in dental pulp
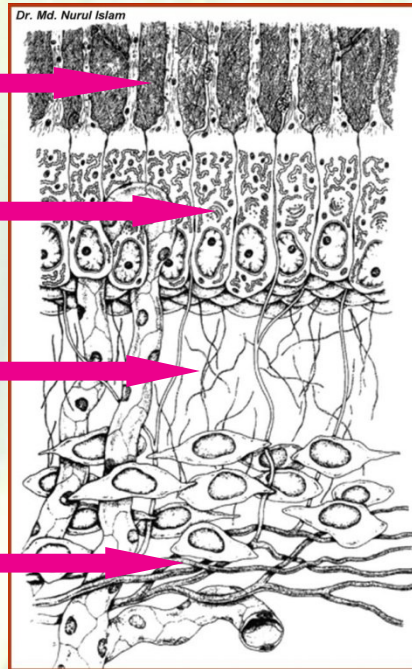
Odontoblasts in dental pulp

Odontoblasts

Dr. Md. Nurul Islam
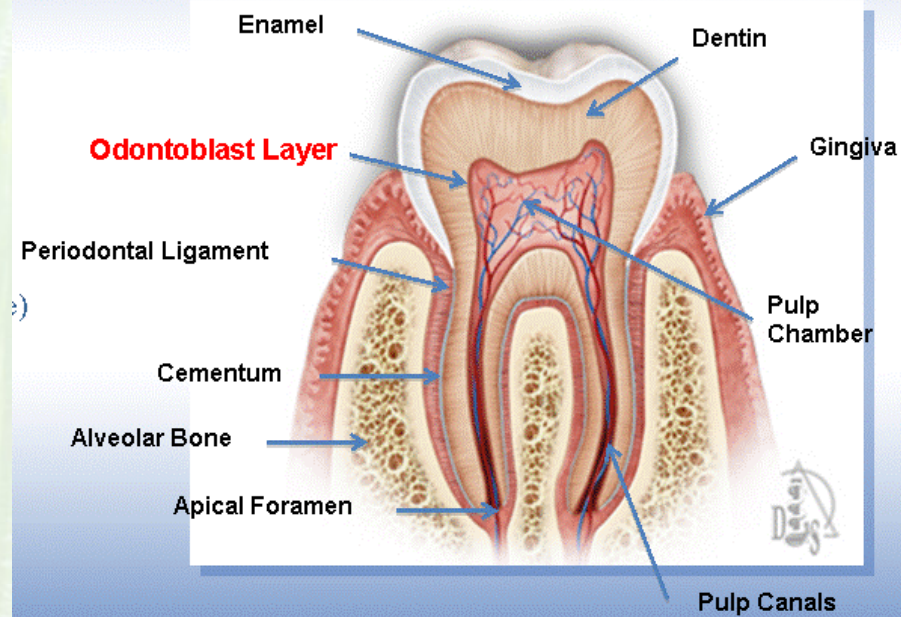
Predentin

Odontoblasts

Cell-free zone

Cell-rich zone

| Zone	Description
Odontoblastic layer	-Lines outer wall - Bodies of ODB - Secondary dentin form in this area
Cell-free zone	Nerve and capillary plexus
Cell-rich zone	Extensive vascular system

Objective

- **Study the changes in the number of odontoblast as being dependent of time**

- **Check and verify the basic characteritics**

- **Temperature**

Materials and methods

- 32 corpses ,18-40yrs

- Jaws : open plastic bag

- Start at single-root tooth

Canine

↓

Premolar
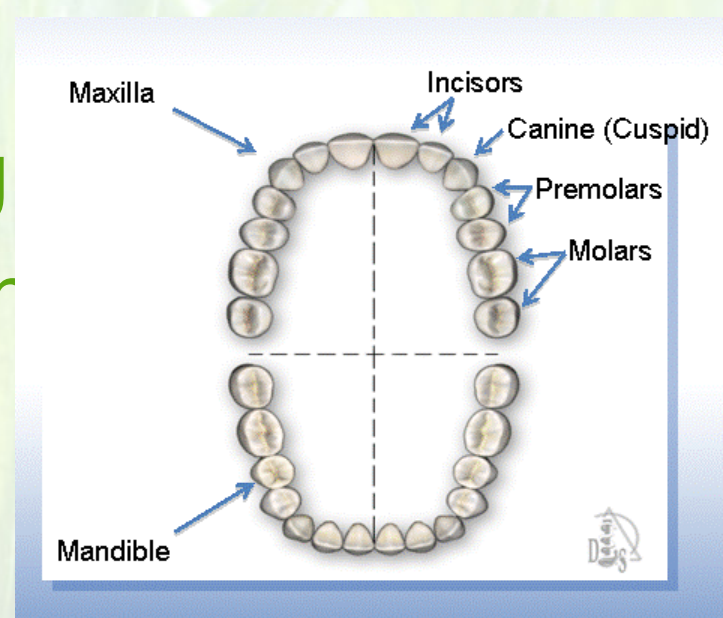
Materials and methods

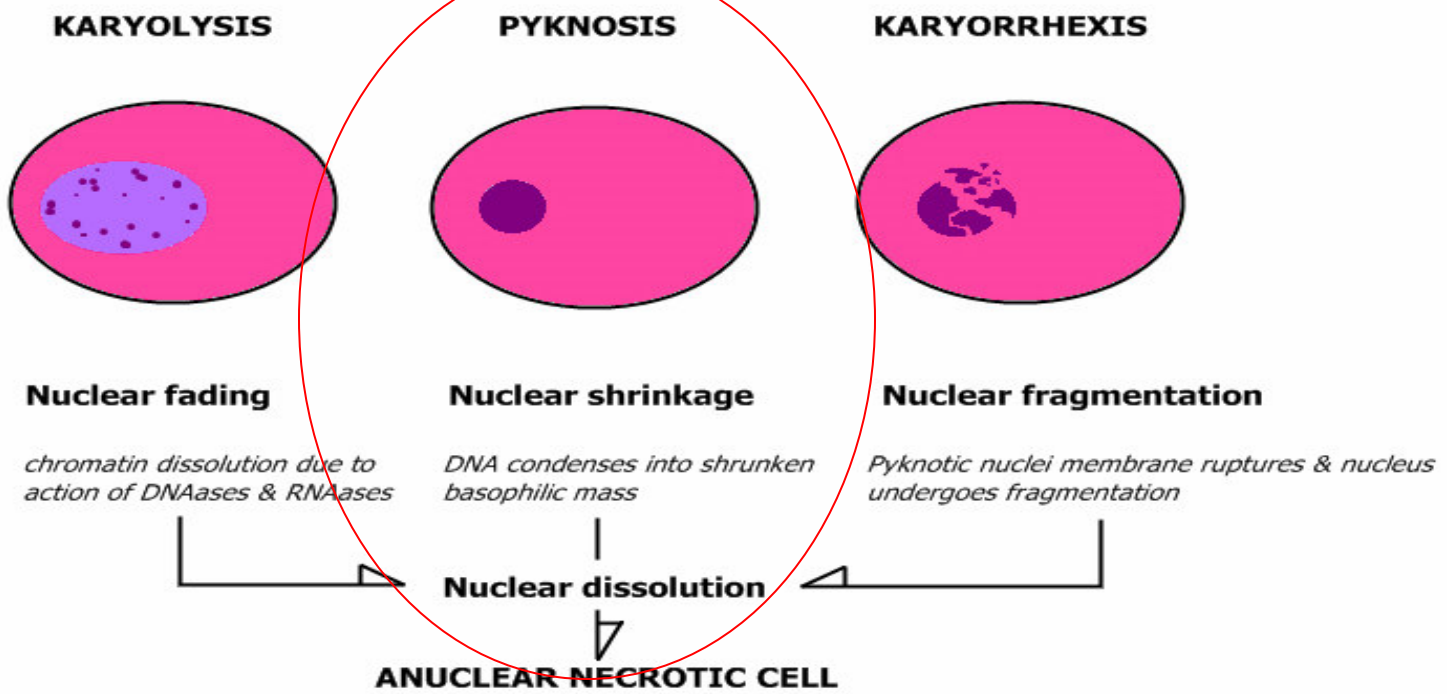- **32 corpses ,18-40yrs**
- **Jaws : open plastic bag : 15 at RT (23℃) and 17 at Refrig (4℃)**
- **Start at single-root tooth**
- **Basic surgical pathologic method**
- **Light microscopy**

Surgical pathologic method

- 4-µm-thin paraffin longitudinal serial section

- H&E stain

- Count and analysed by light microscope

Odontoblast with nuclei with condensed chromatin or pyknosis

SPSS for MS windows

What is 'Pyknosis'??

KARYOLYSIS — **PYKNOSIS** — **KARYORRHEXIS**

Nuclear fading — **Nuclear shrinkage** — **Nuclear fragmentation**

chromatin dissolution due to action of DNAases & RNAases

DNA condenses into shrunken basophilic mass

Pyknotic nuclei membrane ruptures & nucleus undergoes fragmentation

Nuclear dissolution

ANUCLEAR NECROTIC CELL

Results

1. Density of odontoblasts
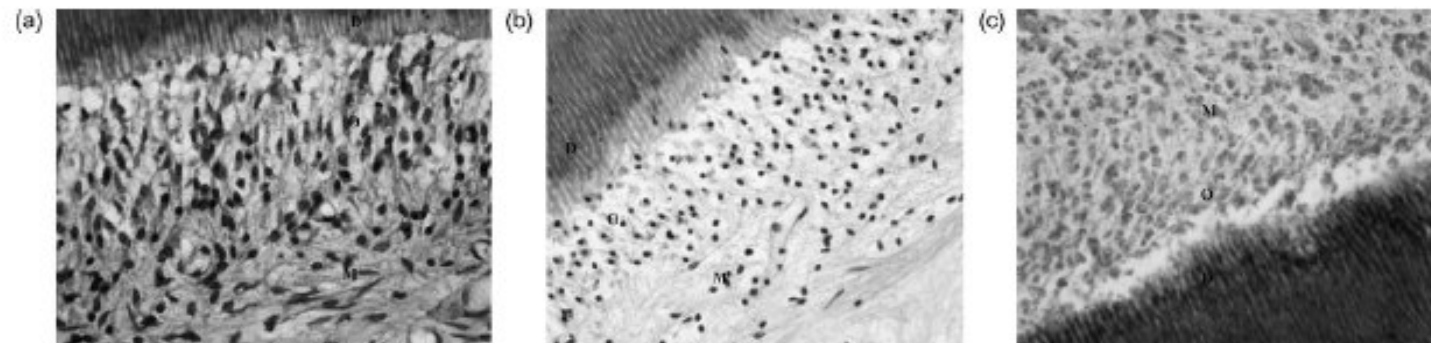
- sample the 1st 24hr : 11,746 /mm^2

Fig. 1. The layer of odontoblasts in human dental pulp 7 h (a), 55 h (b) and 103 h (c) after death at room temperature. D: dentin, O: layer of odontoblasts, M: middle part of the dental pulp. Hematoxylin and eosin, 40×.

Results

1. **Density of odontoblasts**

- **sample the 1st 24hr : 11,746 /mm^2**

2. **Linear regression model for absolute values of density of odontoblasts**

Results

- $OD_s = \alpha + \beta_{OD'}OD'_c + \beta_t t_s + u_s$

Table 1

Parameters of the linear regression model for estimating the time since death according to the density of odontoblasts per μm^2.

Group	Room temperature	Refrigerated temperature
OD' mean	0.01225	0.01139
OD' S.D.	0.00264	0.00267
Adjusted R^2	0.844	0.759
F-test (P value)	130.388 (0.000)	120.559 (0.000)
a (t-test, P value)	0.00990 (8.563, 0.000)	0.01056 (9.121, 0.000)
b_t (t-test, P value)	−0.00013 (−15.742, 0.000)	−0.00012 (−15.486, 0.000)
$b_{OD'}$ (t-test, P value)	0.34372 (4.023, 0.000)	0.19931 (2.127, 0.037)

Results

- **Average drop : 130/mm^2/hr at 23ºC**

- **Average drop : 120/mm^2/hr at 4 ºC**

H0 :$\beta_{tRoom}=\beta_{tRefrig}$ (t= -1.0937, P=0.276)

Could not reject this hypothesis

Results

- $\hat{O}D_s = a + b_{OD'}OD'_c + b_t t_s$

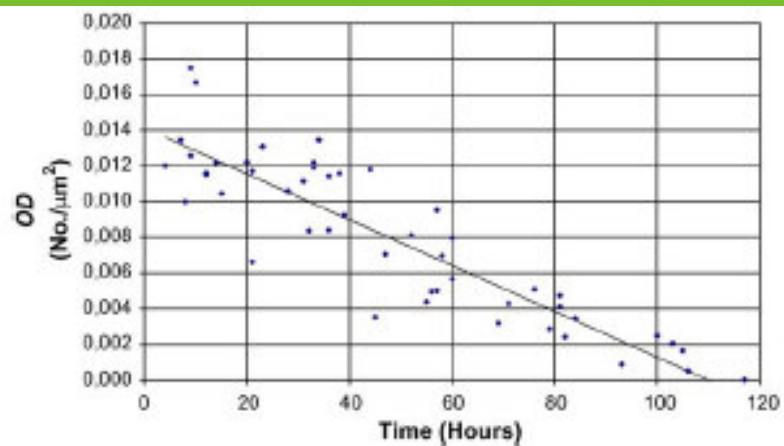- $0 \quad = a + b_{OD'}OD'_c + b_t t_s$

Result

Fig. 3. Density of odontoblasts vs. time of death for cases at room temperature.

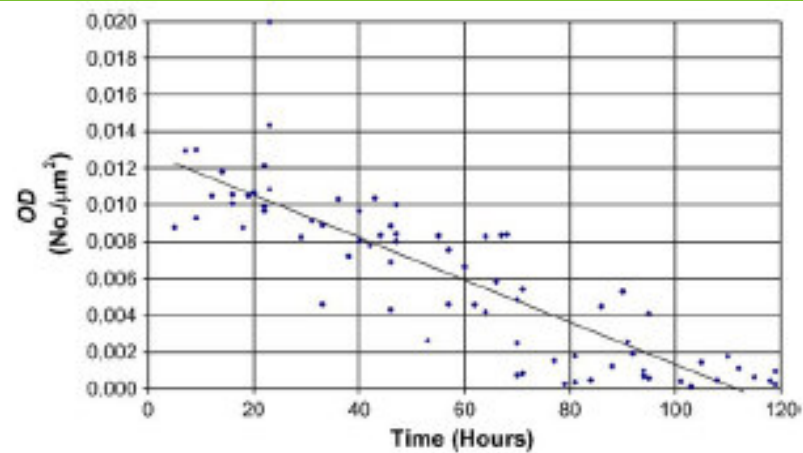**Fig. 4.** Density of odontoblasts vs. time of death for cases at 4 °C.

Result

- **Average time of persistance of odontoblast after death (95%CI)**

  - **110.03±14.12 hr or 4.58±0.59 days at RT**

  - **111.53±9.35 hr or 4.64±o.38 days at Refrig**

Results

3. Linear regression model for relative values of odontoblasts density

Table 2

Parameters of the linear regression model for estimating the time since death according to relative density of odontoblasts per μm^2.

Group	Room temperature	Refrigerated temperature
Adjusted R^2	0.884	0.792
F-test (P value)	365.223 (0.000)	289.583 (0.000)
a (t-test, P value)	1.14462 (37.292, 0.000)	1.14500 (27.758, 0.000)
b_1 (t-test, P value)	−0.01025 (−19.111, 0.000)	−0.01015 (−17.017, 0.000)

Result

- **Relative density**
  : average drops by 1.025% /hr at RT
  $\qquad\qquad\qquad\qquad$ **1.015% /hr at 4˚C**

- $H_0 : \beta_{tRoom} = \beta_{tRefrig}$
- (t=-0.1071 , P=0.915)

Conclusions

- **Average density : Correspond and confirms**
- **Average drop : 130/mm^2/hr at RT**
- **Average drop : 120/mm^2/hr at 4 ºC**

Conclusions

- **Average time of persistance of odontoblast after death**
  - **110.03±14.12 hr or 4.58±0.59 days at RT**
  - **111.53±9.35 hr or 4.64±o.38 days at Refrig**
- **Lower ambient :NOT slow the disintegration**

Conclusions

- **Relative density**

  : average drops by 1.025%/hr at RT

  $$1.015\%/hr\ at\ 4^{\circ}C$$

- $H_0 : \beta_{tRoom} = \beta_{tRefrig}$
- (t=-0.1071 , P=0.915)

Conclusions

- *Maybe one additional parameter for PMI*
- *More cases are needed to better estimate CI*
- *How odontoblasts die and why/how they disappear*

Thank you for your attention.

+++Imagination is more important than knowledge+++

For knowledge is limited to all we now know and understand while imagination embraces the entire world and all there ever will be to know and understand.