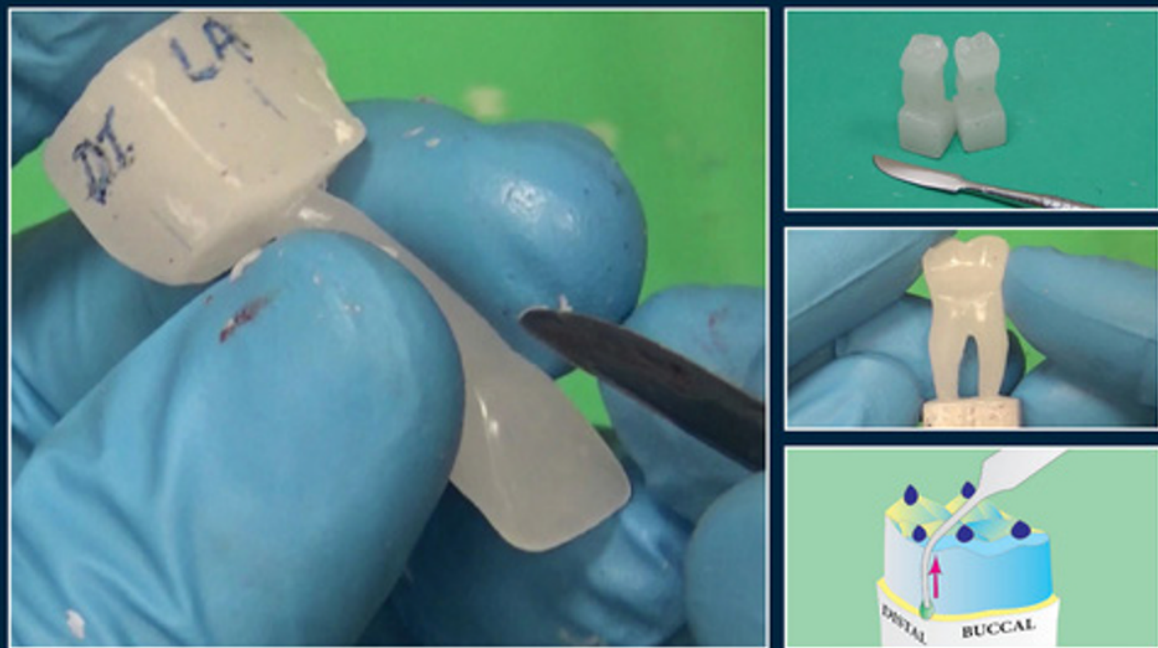


AN ILLUSTRATED ATLAS OF TOOTH CARVING AND WAX-UP TECHNIQUES

ANIL BANGALORE SHIVAPPA



WILEY Blackwell

An Illustrated Atlas of Tooth Carving and Wax-Up Techniques

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Al-Ahsa, Saudi Arabia

WILEY Blackwell

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Preface

As a student and as a teaching faculty member for nearly six years in the course on dental anatomy, I perceived that students in this course found it difficult to understand the concept of carving and waxing in terms of cognitive and psychomotor skills even though they have better knowledge in related subjects.

According to German anatomist and physiologist, Friedrich Tiedemann (1781–1861), ‘Doctors without anatomy are like moles. They work in the dark and the works of their hands are mounds’.

Dentistry, however, does not depend solely on knowledge but also on psychomotor skills. A successful dentist requires manual dexterity along with knowledge. Therefore, this book is written for both undergraduate and postgraduate dental students who find it difficult to carve and wax teeth and appreciate their features. Most students who are beginners in dentistry may not be skilled, and psychomotor and cognitive skill levels vary from person to person. This book is designed to help these students learn the skills or acquire manual dexterity. Carving skills are helpful in dental technician courses during the initial years of their syllabus for carving on wax blocks and plaster blocks as well as for making acrylic teeth and performing wax-up procedures. Skills are useful in both preparation of tooth morphology and adjustments for casting procedures in later stages of their course.

Although there are many books on dental morphology (anatomy), there are not many that teach the skillful technique of carving (which will also be useful in restorative procedures) and waxing. Cognitive and psychomotor skills strengthen students’ ability to effectively achieve the learning outcome.

This book will help students to systematically learn the specific steps of the procedures. For all undergraduate students, postgraduate dental students, and dental lab assistant course students, the book will be very useful for preclinical/lab procedures.

The line diagrams in the book show live demonstrations of the techniques of carving and waxing. They help students face the challenges they encounter in their study and improve their skills. The companion website will provide an overview of the procedural steps.

For exam preparation, this book helps students practise and quickly review the procedures/steps of carving and acquire theoretical knowledge of the morphology of each tooth.

The carving skills for clinicians will help them to provide proper morphology to each tooth, especially in aesthetic procedures and posterior restorative procedures.

This book makes it easy to learn the challenging task of carving (also in restorative procedures) and waxing teeth, using illustrative diagrams in a stepwise manner. It helps in instrumentation, wax preparation for carving, and wax building technique.

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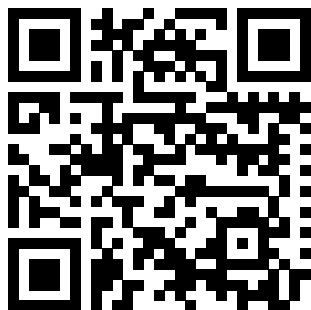
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Don't forget to visit the companion website for this book:

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There you will find valuable material designed to enhance your learning, including learning outcomes for all chapters, video resources and all figures as downloadable PowerPoint slides.



Scan this QR code to visit the companion website.

1

Introduction to Dental Anatomy

LEARNING OBJECTIVE

The student should be able to know the definition of dental anatomy, types of dentition, dental formula, and various tooth numbering systems.

Definition of Dental Anatomy

Dental anatomy is defined as the study of the development, morphology, function, and identity of each of the teeth in human dentition [1].

Types of Human Dentition

There are two types of dentition throughout the life of a human being: deciduous dentition and permanent dentition [1]. Deciduous dentition is also called dentition of childhood or primary dentition. This dentition begins prenatally at about 14 weeks in utero. The complete set of teeth in this dentition is seen from years 2–6. Deciduous dentition consists of 20 teeth, 10 in the upper arch and 10 in the lower arch [1, 2]. Permanent dentition is also known as dentition of adulthood or secondary dentition or *successive dentition*. Permanent dentition is composed of 32 teeth, 16 in the upper arch and 16 in the lower. Teeth seen between the deciduous and permanent dentition periods are in the *transition* or *mixed dentition period* [2]. The transition period lasts from about 6–12 years of age and ends when all the deciduous teeth are shed [1].

Arch

The arch formed by the teeth and upper jawbone is the maxillary arch. The arch formed by the teeth and lower jawbone is the mandibular arch. Both the maxillary and

the mandibular arches have right and left halves known as quadrants [2].

Quadrants

Each dentition is divided into four quadrants named clockwise as upper right, upper left, lower left, and lower right. The left and right quadrants on both jaws are divided by the midsagittal plane so that the upper right quadrant mirrors the upper left quadrant and the lower right quadrant mirrors the lower left quadrant. Within each quadrant there are four classes of teeth: incisors (central and lateral), canines, premolars (first and second), and molars (first, second, and third) [3].

Dental Formula

For Primary Dentition

This formula (Figure 1.1) should be read as two incisors in the maxilla and two incisors in the mandible, one maxillary canine and one mandibular canine; two maxillary and two mandibular molars, altogether 10 on one side, either right or left side [2].

For Permanent Dentition

The dental formula for permanent dentition (Figure 1.2) is read as two incisors in the maxilla and two incisors in the

$$I \frac{2}{2} \quad C \frac{1}{1} \quad M \frac{2}{2} = \frac{5 \text{ Teeth in upper quadrant}}{5 \text{ Teeth in upper quadrant}} = \text{Total 10 teeth on one side}$$

Figure 1.1 Dental formula for deciduous dentition.

$$I \frac{2}{2} \quad C \frac{1}{1} \quad PM \frac{2}{2} \quad M \frac{3}{3} = \frac{8 \text{ Teeth in upper quadrant}}{8 \text{ Teeth in upper quadrant}} = \text{Total 16 teeth on one side}$$

Figure 1.2 Dental formula for permanent dentition.

mandible, one maxillary canine and one mandibular canine, two maxillary and two mandibular premolars, three maxillary and three mandibular molars [2].

Tooth Notation

Universal System

In the *universal* system for primary dentition (Figure 1.3) uppercase letters are used starting from A through J (starting from the right maxillary second molar to the left maxillary second molar) for maxillary teeth and from letters K through T (beginning from the left mandibular second molar ending at the right mandibular second molar) for mandibular teeth [2].

In the universal notation system for permanent dentition (Figure 1.4), numbers from 1 through 32 are used for the full set of teeth. The maxillary teeth are numbered from 1 through 16 (beginning from the right maxillary third molar as tooth no. 1 ending at the left maxillary third molar as tooth no. 16). Mandibular teeth are numbered from 17 through 32 (beginning from the left mandibular third molar as tooth no. 17, ending at the right mandibular third molar as tooth no. 32) [2].

Zsigmondy Palmer Notation

In this system both the maxillary and mandibular arches are divided into two quadrants, so that there are a total of four quadrants in the oral cavity, each quadrant with a set of teeth as follows [2, 3]:

Right	A	B	C	D	E	F	G	H	I	J	Left
	T	S	R	Q	P	O	N	M	L	K	

Figure 1.3 Universal system for primary dentition.

Right	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Left
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	

Figure 1.4 Universal system for permanent dentition.

For Primary Teeth

In each quadrant capital letters are used to denote teeth, from A (for central incisor) to E (for second molar); see Figure 1.5 [2].

For Permanent Teeth

In each quadrant, numbers are used to denote teeth from 1 (for central incisor) to 8 (for third molar); see Figure 1.6 [2, 3].

Upper Right	Upper Left
EDCBA	ABCDE
EDCBA	ABCDE
Lower Right	Lower Left

Figure 1.5 Zsigmondy Palmer notation for primary dentition.

Upper Right	Upper Left
87654321	12345678
87654321	12345678
Lower Right	Lower Left

Figure 1.6 Zsigmondy Palmer notation for permanent dentition.

FDI System

A two-digit system proposed by Fédération Dentaire Internationale (FDI): In this system, the first number indicates the quadrant and the second number indicates a particular tooth (Figures 1.7 and 1.8) [2, 3].

For the Primary Teeth

Upper Right					Upper Left				
55	54	53	52	51	61	62	63	64	65
85	84	83	82	81	71	72	73	74	75
Lower Right					Lower Left				

Figure 1.7 FDI system for primary dentition.

For the Permanent Teeth

Upper Right								Upper Left							
18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Lower Right								Lower Left							

Figure 1.8 FDI system for permanent dentition.

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2

Armamentarium

LEARNING OBJECTIVE

At the end of the chapter, the student should have knowledge of the various applications of the armamentarium used for tooth carving and wax-up technique.

Wax Block

Carving wax (Figure 2.1) is used in dentistry to study and simulate dental anatomy.

Content of carving wax includes

- i) Paraffin wax (55–60%)
Solid hydrocarbon mixture obtained from petroleum products. The straight-chain hydrocarbon has 26 carbon atoms.
- ii) Beeswax (5%)
Obtained from honeycombs. Composition includes ester complex mixture, saturated and unsaturated hydrocarbons, and high molecular weight organic acid. Two types of beeswax are used: yellow beeswax and bleached beeswax.
- iii) Carnauba wax (25%)
An exudate obtained from the pores of the leaves of the Brazilian wax palm tree (*Copernicia prunifera*). It is used to increase melting point and hardness of the paraffin.
- iv) Inorganic filler (10–15%)
Most commonly used filler particles are silica and calcium bentonite. Increases hardness, linear thermal expansion, and melting point of carving wax. Filler materials are also added to increase toughness, improve accuracy, obtain smoother carving, avoid bubbles and flaking, and free models and instruments from tackiness [1, 2].

Inlay Wax

Inlay wax is used in waxing or building the anatomy of the tooth for crowns and bridge units that are formed by a casting

process using lost-wax pattern technique. It may contain 60% paraffin, 25% carnauba, 10% ceresin, and 5% beeswax. Based on their flow, inlay waxes are classified as hard, regular (medium), or soft. The flow of the inlay wax can be reduced by increasing the percentage of composition of carnauba wax or by adding a paraffin wax with a higher melting point or small amount of resin. Inlay waxes are available in various colours such as deep blue, green, or purple and in various forms such as small pellets or cones or in jars [3].

Lecron Carver

The Lecron carver is a stainless-steel instrument used for carving tooth morphology on carving wax. It is also used for carving on inlay wax [4].

It has the following parts (Figure 2.2):

- i) The knife end
- ii) The spoon end/excavating end
- iii) The handle
- iv) The shank

The Knife End

Cutting Edge

The knife end has a cutting edge or blade which has a curved anterior part (Figure 2.3a). This edge is used for carving bulk wax. This part of the cutting edge also helps in creating concavities (Figure 2.3b) on the wax surface (eg, in creating the concave lingual or palatal outline of the anterior teeth) [5].

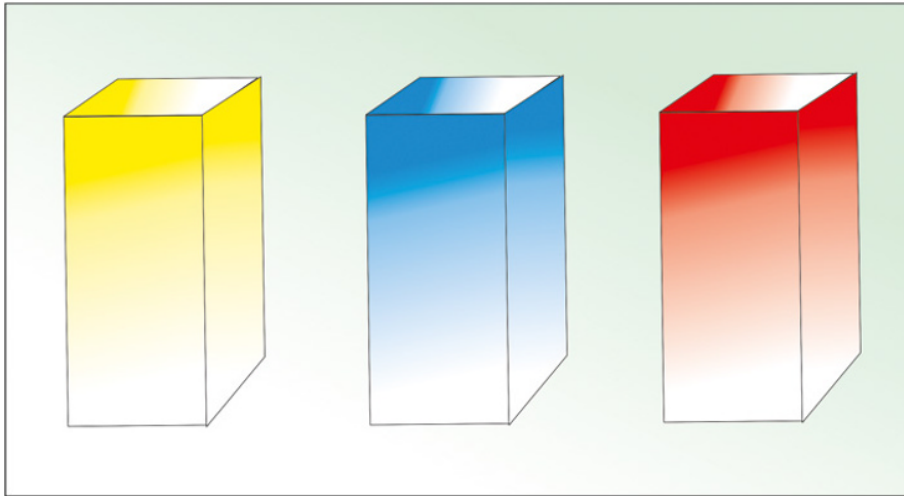


Figure 2.1 Rectangular wax block used for carving human dentition.

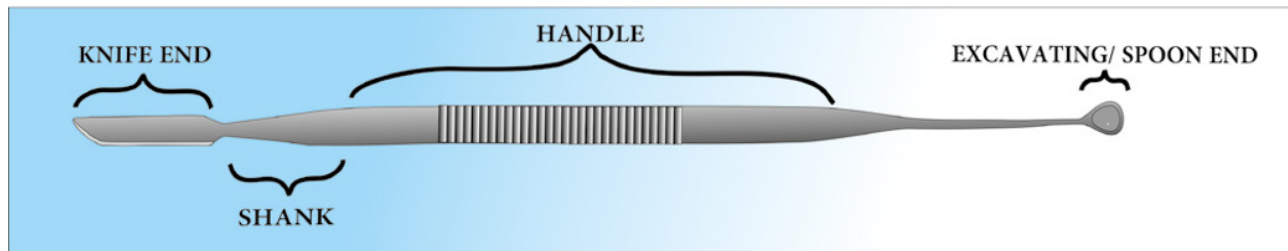


Figure 2.2 Parts of the Lecron carver.

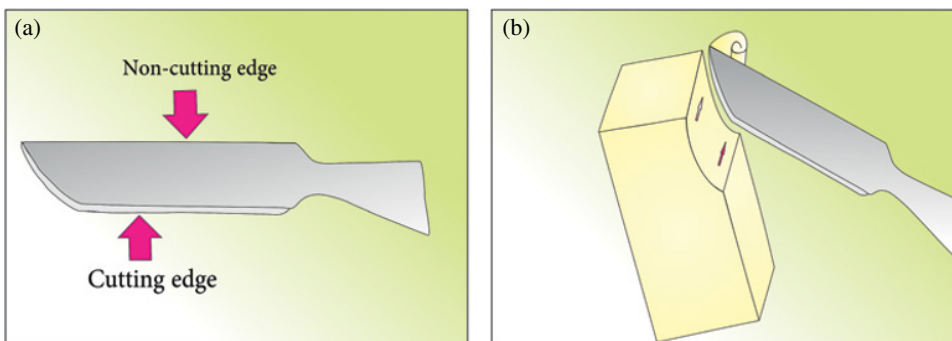


Figure 2.3 Edges of the knife end of the Lecron carver.

Non-cutting Edge/Side

The non-cutting edge/side is used for smoothing wax and creating the slopes of the triangular ridge. Figure 2.4 shows the carving of the mesial slope (2.4a) and distal slope (2.4b) of the mandibular first molar mesiobuccal cusp.

The Spoon End/Excavating End

This end is used in carving lingual or palatal fossae on the crown of anterior teeth and developmental

depression on the roots of all teeth (Figure 2.5a–d), by excavating wax [6].

The Handle

This part of the instrument is used to hold the carver (Figure 2.2) [7].

The Shank

The shank connects handle to knife (Figure 2.2). It may be either straight or angled. In carvers the shank is straight [8].

Figure 2.4 Carving the slopes of the triangular ridge using the non-cutting side of the carver.

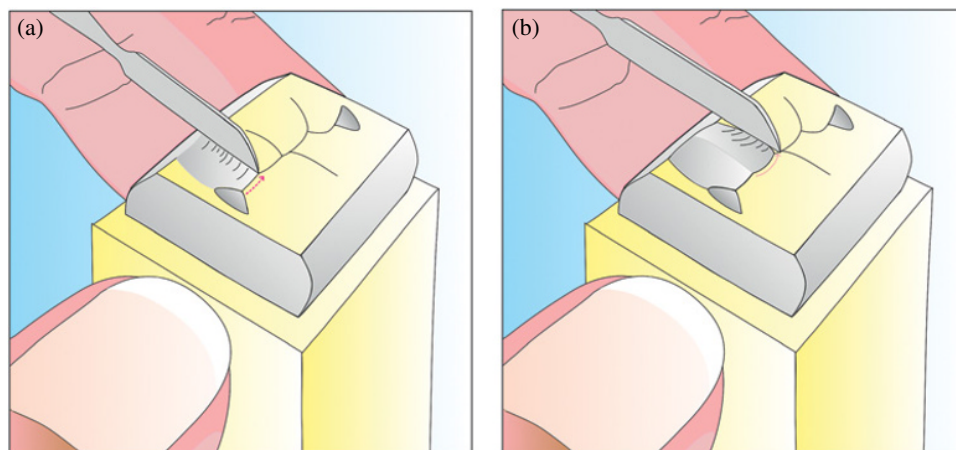
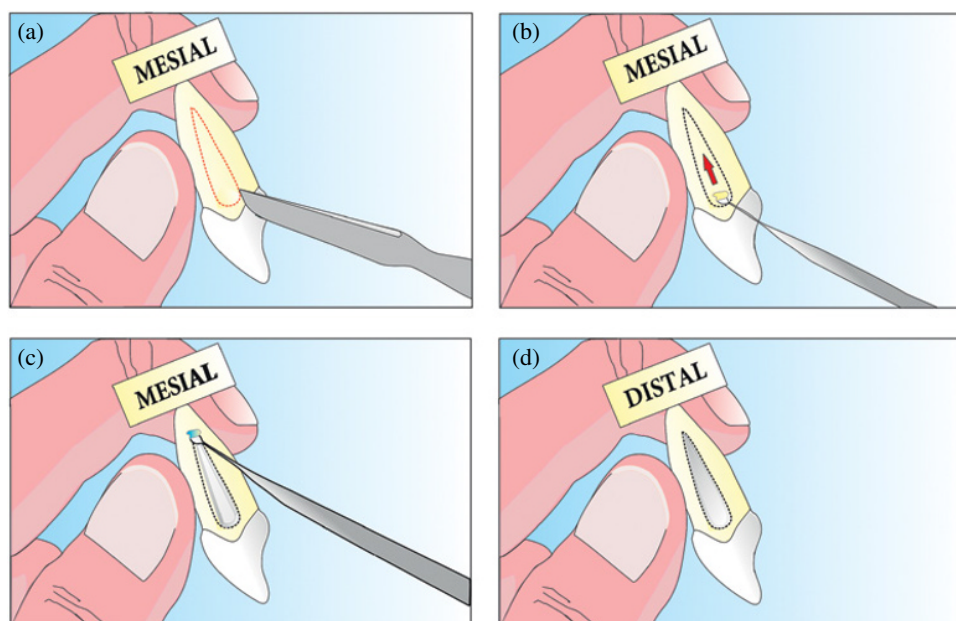


Figure 2.5 (a–d) Carving the developmental depression on the root portion using the spoon end of the carver.



Metallic Scale or Ruler

The metallic scale (Figure 2.6) is used to measure the dimension of the carving before and after the carving procedure.

Vernier Caliper

The Vernier caliper (Figure 2.7) is an aid used to measure

- i) Diameter of a small spherical/cylindrical body

- ii) The dimensions of a given regular body of known mass and hence to determine its density

It has a main scale and a sliding Vernier scale and four jaws [8].

Waxing Instruments

Based on their use waxing instruments are classified as wax addition, carving, or burnishing. PKT instruments (Figure 2.8) used for waxing technique were designed by



Figure 2.6 Metallic scale with markings in centimetres.

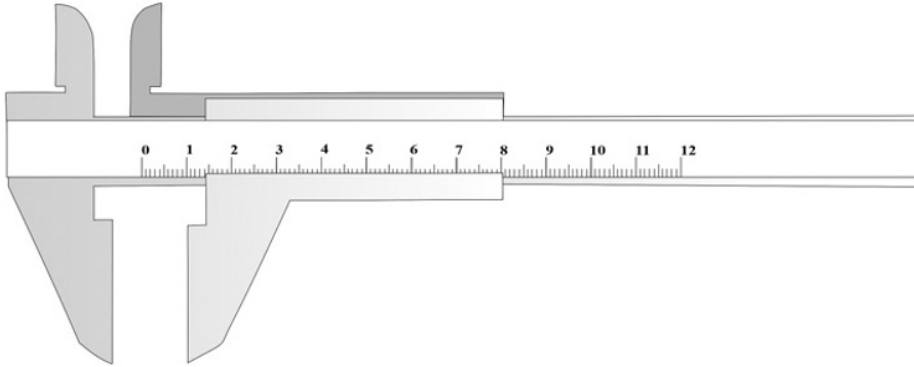
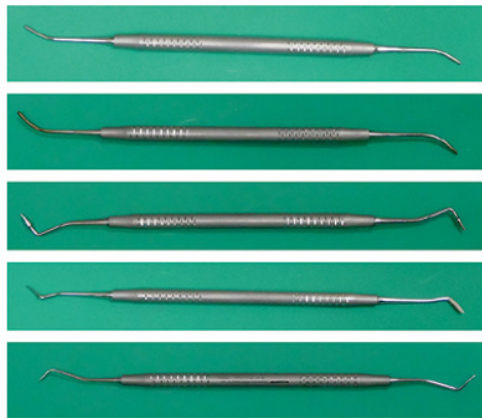


Figure 2.7 Vernier caliper.



PKT No. 1

PKT No. 2

PKT No. 3

PKT No. 4

PKT No. 5

Figure 2.8 PKT instruments set.

Dr. Peter K. Thomas. PKT no. 1 and no. 2 are used for adding wax. (They can also be used for burnishing.) PKT no. 3 is a burnisher for refining the occlusal anatomy, and PKT nos. 4 and 5 instruments are wax carvers. For larger increments of wax, PKT no. 1 is used; for smaller increments, PKT no. 2 is used. A no. 7 waxing spatula is used for adding large increments of wax, especially for the initial coating. Wax is melted by heating the instrument first near its shank, then touching the wax and quickly reheating the shank [9].

Instrument Grasps

The modified pen grasp improves the tactile sense. The pads of the thumb and of the index and middle fingers contact the instrument, while the tip of the ring finger (or tips of the ring and little fingers) is placed on the opposing hand to obtain the rest (Figure 2.10a and b) [7].

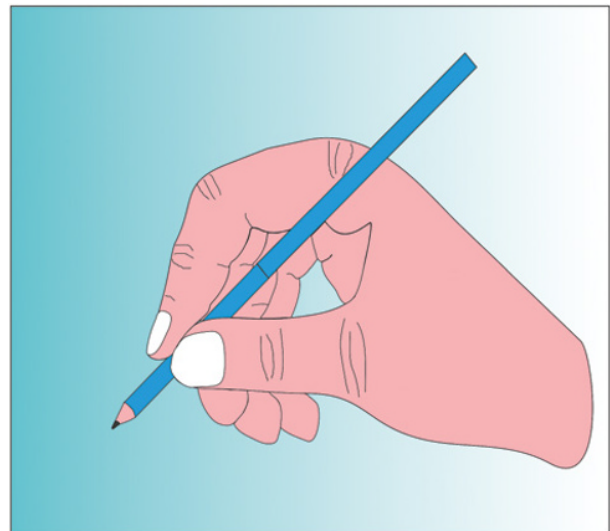


Figure 2.9 Pen grasp.

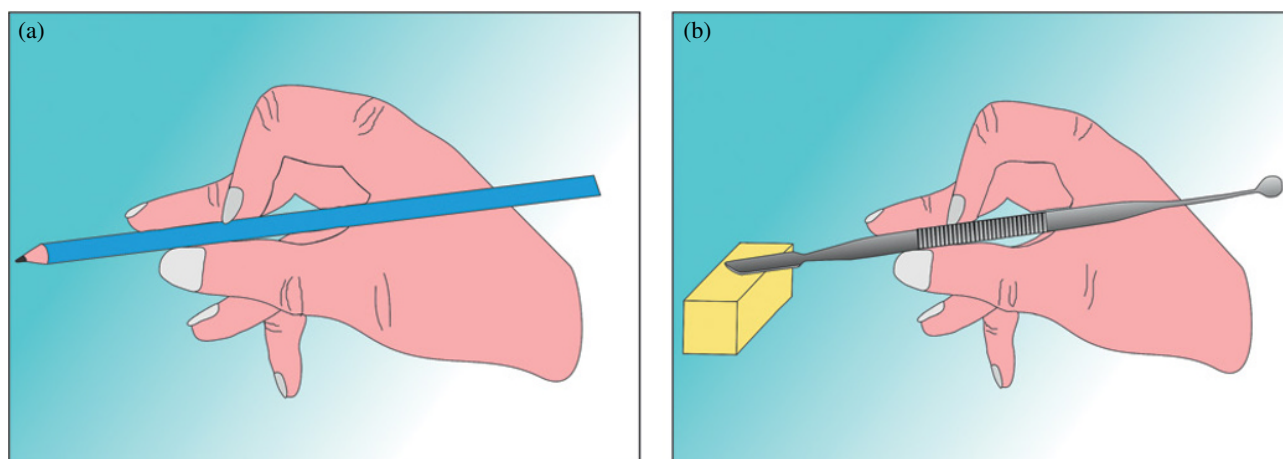


Figure 2.10 Modified pen grasp used for holding the instruments.

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