

## CHAPTER 6

### RESULTS - MORPHOLOGY OF THE HAND BONES

#### 6.1 General introduction

In this section, a description of the morphology and siding of the metacarpals and phalanges will be given. The basic descriptions of these bones will come from the literature, to which additional features found in this study will then be added. These additional features will be indicated by a number in brackets which corresponds to the number on the relevant figure. A description of each bone will be provided under the headings of shaft, head and base.

The metacarpals in the literature are described in greater detail than the phalanges. For this reason, there is an introduction before each metacarpal bone and not for the phalanges in this study.

#### 6.2 Morphology of the first metacarpal (Figures 6.1a-f)

##### 6.2.1 Introduction

The first metacarpal is the most lateral digit in the anatomically positioned hand (Matshes *et al.* 2005). It is often described as being the shortest and most robust when compared to adjacent metacarpals (Gray 1989, 1995, Matshes *et al.* 2005, Scheuer & Black 2000). The first metacarpal articulates with the trapezium proximally and the first proximal phalanx distally (Matshes *et al.* 2005, Scheuer & Black 2000).

The shape of the shaft is described from two aspects, namely, the transverse and longitudinal plane. In the transverse plane it is said to have a flattened dorsal and convex palmar surface. In the longitudinal plane, the shaft is described as being concave on the palmar aspect (Scheuer & Black 2000).

Surface markings on the palmar aspect of the shaft include a round ridge which divides the palmar aspect into a larger lateral area for attachment of opponens pollicis and a smaller medial surface for attachment of the lateral head of the first dorsal interosseous muscle (Scheuer & Black 2000).

Nutrient foramina have been identified on the dorsal (Patake & Mysorekar 1977) and medial palmar surface of the distal end of the shaft (Scheuer & Black 2000). At the proximal end of the shaft, tubercles are evident on the lateral and medial ends. These tubercles serve for attachment of abductor pollicis longus laterally and first palmar interosseous medially (Scheuer & Black 2000). The head is described as being large and round and tilted in a palmar direction (Bass 1995).

Scheuer and Black (2000) describe the base as being concavo-convex, thus creating two surfaces separated by a less prominent ridge for articulation with the saddle-shaped trapezium. This ridge is said to be continuous with the medially directed styloid process on the palmar aspect of the base (Scheuer & Black 2000). The first metacarpal is considered to be the most dimorphic bone in the series of metacarpals which relates to its function as a power grip digit.

Gray (1959) describes the shaft of the first metacarpal as a longitudinal curve with three surfaces, namely, medial, lateral and dorsal. He also describes the distal two-thirds as smooth dorsally, triangular in form and flattened. He lists two small tubercles on either side of the distal extremity which converge proximally to form a centrally located ridge and describes the medial margin of the shaft seen from the volar (palmar) surface, as concave from superior to inferior and divided by a rounded ridge into a larger anterolateral and a smaller anteromedial surface. He notes the presence of a large lateral and a small medial articular eminence which provides a surface for gliding of the sesamoid bones. The dorsal surface is described by this author as rotated laterally.

Identification and siding of a metacarpal to a particular ray is said to be easier when the base is present. Difficulties arise in cases when bone fragments or only the head or distal segment is present (Ricklan 1987). For the purpose of the present study, bony landmarks as well additional features not mentioned in textbooks, will be noted and described under the headings of shaft, head and base as seen from a dorsal, palmar, lateral, medial, superior and inferior view. This should make it easy to identify and side any part of this bone.

### 6.2.2 Shaft or body (Figures 6.1a-d)

A dorsal view of the shaft (Figure 6.1a) shows a medial margin (3 - dotted line) that is straight in the central part. As this margin is followed through to the distal end it curves slightly medially, forming an obtuse angle before merging with the dorsal medial tubercle (2). This tubercle is evident only from the medial and dorsal aspect. At the proximal end, the medial margin forms another angle as it projects outward. In contrast, the lateral margin (8 - dotted line) is concaved laterally throughout its course and becomes less prominent distally before merging with the dorsal lateral tubercle of the head (7). At the proximal end the lateral margin forms a prominent outward projection which tends to curl laterally, forming a rounded tip as it merges with dorsal lateral articular margin of the base (10). The dorsal surface is flattened from proximal to distal and has greater width distally than proximally.

From a palmar view (Figure 6.1b) a centrally positioned palmar median ridge of the shaft (13) can be identified. The ridge creates two surfaces, namely, the palmar lateral (9) and palmar medial (16) surfaces of the shaft. If followed through to the proximal end, this ridge merges with the proximal palmar tubercle of the shaft (17).

A lateral view of the shaft (Figure 6.1c) depicts the dorsal lateral tubercle (7) with a prominent lateral margin (8) extending from it in a proximal direction. The lateral margin is rough in its distal half and smooth in the proximal half where it deviates onto the dorsal surface of the shaft. A line demarcating the junction between the base and the proximal end of the shaft (21) is evident. This line is slightly distal to the lateral articular margin of the base (22). The palmar lateral surface of the shaft (9) can be seen from this view.

A medial view of the shaft (Figure 6.1d) shows a round and smooth medial margin (3) compared to the rough lateral margin. The dorsal surface is flattened compared to the concave palmar surface. The palmar medial surface of the shaft (16) can be identified as a slight concavity.

### 6.2.3 Head (Figures 6.1a-e)

The head is described in the literature as being large and round (Romanes 1991, Bass 1995), asymmetrical and projecting more towards the palmar than towards the dorsal aspect (Scheuer & Black 2000). It is broader medial laterally and less convex than that of adjacent metacarpals (Gray 1932, Scheuer & Black 2000). The enlarged lateral and medial angles are referred to as articular eminences for sesamoid bones that will develop within the tendons of adductor pollicis longus and the first palmar interosseous muscles medially and the flexor pollicis brevis laterally (Scheuer & Black 2000). Additional features of the head as observed in the present study are discussed below.

From a dorsal view, the head, which is located at the distal end of the shaft (Figure 6.1a), shows greater width than height. The dorsal articulating margin of the head (1) which separates the head from the shaft runs from the dorsal medial tubercle (2) to the dorsal lateral tubercle of the head (7). The dorsal lateral tubercle is positioned more distally than the dorsal medial tubercle.

While very little of the head is seen from the dorsal aspect, the palmar view shows more detail (Figure 6.1b). The palmar articular margin (11) which separates the head from the shaft extends from the palmar lateral tubercle (12) to the palmar medial tubercle (15) of the head. The head is not as wide from this view when compared to the dorsal view, making it possible to identify the dorsal medial tubercle (2) and the dorsal lateral tubercle of the head (7). Not only are these palmar tubercles closer to each other accounting for the smaller width of the head, they are also positioned more distally than the dorsal tubercles. The palmar tubercles tend to have sharper end points than the more rounded ends of the dorsal tubercles. A comparison of the palmar tubercles shows that the palmar lateral tubercle is relatively larger and projects more proximally than the palmar medial tubercle.

From a lateral view (Figure 6.1c) the dorsal lateral tubercle (7) and palmar lateral tubercle (12) are separated from each other by the lateral intertubercular fossa (20). The palmar lateral tubercle is elongated and projects downward or proximally when compared to the relatively smaller, round dorsal palmar tubercle.

Landmarks from a medial view of the head (Figure 6.1d) are similar to that seen from a lateral view except that different terminologies are used. From a medial view, the dorsal medial tubercle (2) is separated from the palmar medial tubercle (15) by a medial intertubercular fossa (23). Both these tubercles are relatively smaller and less prominent when compared to those on the lateral side. This is especially true for the palmar medial tubercle (15) which is not as elongated as the palmar lateral tubercle (12).

While bony landmarks of the first metacarpal head are described from each view described above, the head as seen from a superior view (Figure 6.1e) is rhomboidal in shape. From this view, the greater width dorsally is due to the outward extensions of the dorsal lateral and dorsal medial tubercles. The articulating margin (Figure 6.1e, dotted line) forms the boundary of the articular surface. The lateral intertubercular fossa (20) lies medial to the dorsal lateral tubercle (7) while the medial intertubercular fossa (23) lies lateral to the dorsal medial tubercle (2).

#### **6.2.4 Base (Figures 6.1a-d and f)**

The outline of the base of the first metacarpal is described as being cubical (Romanes 1991) or rhomboidal in shape while the articulating surface is saddle-shaped (Hollinshead & Rosse 1985) for articulation with the greater multangular bone (Gray 1932), trapezium (Hollinshead & Rosse 1985) and the scaphoid bone (Gray 1932, Hollinshead & Rosse 1985, Romanes 1991). In the present study, the base was observed to be oval to square in shape. The articular surface of the base is described as concavo-convex (Gray 1932). According to Gray, there are no articulating facets on the lateral aspect of the base, except for the presence of a tubercle located laterally. Additional features of the base as observed in the present study is described below and shown in Figures 6.1a to d and f.

From a dorsal view (Figure 6.1a) the articulating margin appears to be round. On closer observation, the articular margin has two slopes, namely, a shorter straight dorsal medial

articular margin (4) and a longer curved dorsal lateral articular margin (10). The point where these two margins meet is called the dorsal apex of the base (6).

The palmar view (Figure 6.1b) of the base is very similar to that observed from a dorsal aspect. The two slopes forming the articular margin are the palmar lateral articular margin (14) and palmar medial articular margin (18). The point where these two margins meet is referred to as the palmar apex of the base (19) which is more medially than laterally positioned.

On the lateral view (Figure 6.1c) a line differentiating the base from the rest of the shaft (21) is located distal to the lateral articular margin of the base (22). This articular margin has a relatively longer slope running in a palmar direction when compared to the dorsal slope. The lateral articular margin (22) is also at a higher or more distal level than that on the medial side (25). Part of the concavo-convex articulating surface of the base can be seen from this view.

The medial surface (Figure 6.1d) of the base is different from the lateral view. The articular margin is set at a lower or more proximal level compared to that on the lateral side (25). Furthermore, the line between the base and shaft is straight and not curved as seen from a lateral side.

The articular surface of the base (Figure 6.1f) is divided into two articular surfaces by an interarticular ridge (26) which runs from lateral to medial. These two surfaces are called the dorsal (28) and palmar (27) articular surfaces of the base. The articular surfaces are surrounded by an articular margin. The latter is labelled according to the view that it is observed from, namely, lateral (22), medial (25), dorsal lateral (10), dorsal medial (4), palmar lateral (14) and palmar medial (16). The terminology used for the articular margin makes it easy to identify and side this bone.

### **6.2.5 Siding**

In order to differentiate the right first metacarpal from the corresponding one on the left side, most authors have orientated the bone in such a way that the palmar surface faces down and the dorsal surface faces up or towards one, while the head is placed at the top end and

the base at the bottom end (Bass 1995, Matshes *et al.* 2005). It has been suggested that the pivot-shaped base will tend to slant more towards the same side (10 and 14) as that to which the bone belongs to (Matshes *et al.* 2005).

Additional landmarks which Matshes *et al.* (2005) list as key identifying features include the large articular facet on the lateral aspect of the base, the most prominent nodular eminence found distally on the palmar aspect, a feature which is called the palmar lateral tubercle (12) in the present study, all of which occurs on the same side as that to which the bone belongs to the oblique metacarpal ridge which starts on the same side of the head as that to which the bone belongs to (Matshes *et al.* 2005).

For the purpose of the present study, a list of bony landmarks on the shaft, head and base of the first metacarpal will now be provided. This is to overcome any problems that may be encountered if only a fragment of the first metacarpal is found amongst skeletal remains.

### Shaft

1. Straight medial margin (3) (Figure 6.1a)
2. Curved lateral margin (8) (Figure 6.1a)
3. Smaller palmar medial (16) and larger palmar lateral (9) surface (Figure 6.1b)
4. Palmar medial ridge (13) concave towards the medial surface (Figure 6.1b)

### Head

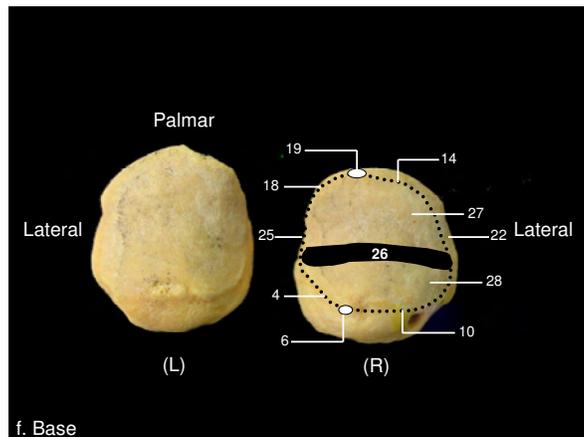
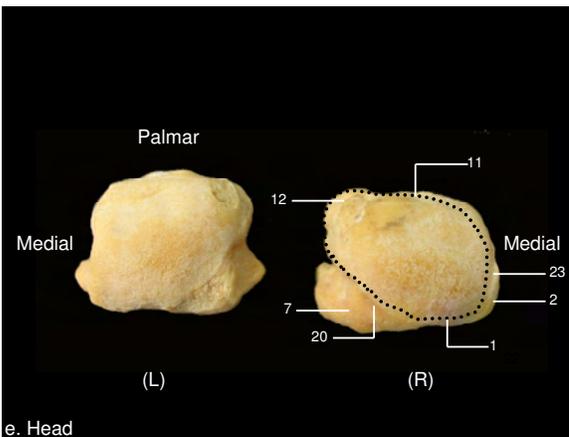
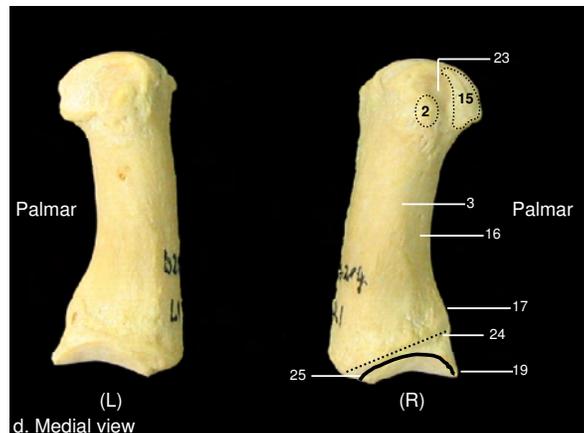
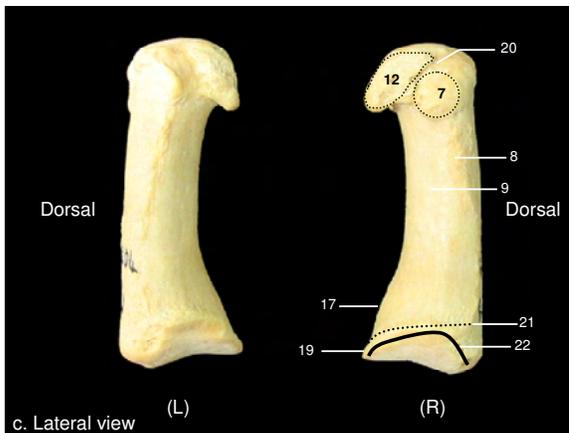
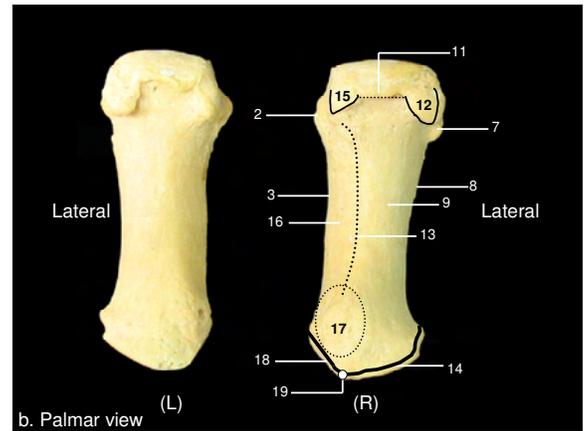
1. Greater width dorsally than on the palmar aspect (Figure 6.1e)
2. Four tubercles:
  - a) Dorsal tubercles relatively smaller and rounder (dorsal view) than larger and pointed palmar tubercles (Figure 6.1b)
  - b) Palmar lateral tubercle (12) relatively longer than palmar medial tubercle (15) (Figure 6.1b)

### Base

1. Dorsal (6) and palmar (19) apices directed more medially (Figures 6.1a and b)

2. Dorsal medial articular margin (4) relatively shorter than the dorsal lateral articular margin (10) (Figure 6.1a)
3. Palmar medial articular margin (18) relatively shorter than the palmar lateral articular margin (14) (Figure 6.1b)
4. Lateral articular margin (22) higher or more distally placed than the medial articular margin (25) (Figures 6.1c and d)

Figure 6.1: Morphology of the right (R) and left (L) first metacarpal



1=dorsal articular margin of the head, 2=dorsal medial tubercle of head, 3=dorsal medial margin of shaft, 4=dorsal medial articular margin of base, 5=dorsal articular surface of base, 6=dorsal apex of base, 7=dorsal lateral tubercle of head, 8=dorsal lateral margin of shaft, 9=palmar lateral surface of shaft, 10=dorsal lateral articular margin of base, 11=palmar articular margin of head, 12=palmar lateral tubercle of head, 13=palmar median ridge of shaft, 14=palmar lateral articular margin of the base, 15=palmar medial tubercle of head, 16=palmar medial surface of shaft, 17=proximal palmar tubercle of shaft, 18=palmar medial articular margin of base, 19=palmar apex of base, 20=lateral intertubercular fossa, 21=lateral junction line between shaft and base, 22=lateral articular margin of base, 23=medial intertubercular fossa, 24=medial junction line between shaft and base, 25=medial articular margin of base, 26=interarticular ridge of base, 27=palmar articular surface of base, 28=dorsal articular surface of base

### **6.3 Morphology of the second metacarpal (Figures 6.2a-f)**

#### **6.3.1 Introduction**

The second metacarpal is the bone associated with the index finger. It is medial to the first and lateral to the third metacarpal. The fact that it is adjacent to the thumb which is the most important digit in the hand, places it second on the list of importance (Scheuer & Black 2000). It is considered to play an important biomechanical role in power and precision grip (Scheuer & Black 2000).

The second metacarpal articulates with the distal row of carpal bones which are listed from lateral to medial as the trapezium, trapezoid and capitate. It also articulates with the base of the first and third metacarpal and with the base of the proximal phalanx of the index finger (Matshes *et al.* 2005). Features listed as unique for this bone is that it is the longest in the metacarpal series and the only bone with a wedge-shaped base (Matshes *et al.* 2005). Authors have used this digit in determining bone mass with age, especially with regard to the development of osteoporosis in postmenopausal women (MacLennan & Caird 1973).

A detailed description of the second metacarpal in the present study, under the headings of head, shaft and base as seen from a dorsal, palmar, lateral, medial, superior and inferior view, will now be discussed in conjunction with descriptions given in the literature.

#### **6.3.2 Shaft or body (Figures 6.2a-d)**

The shaft of the second metacarpal is described as being convexed dorsally and concaved on its palmar aspect (Matshes *et al.* 2005). The palmar aspect of the shaft is described as having two surfaces, namely a palmar medial and palmar lateral surface separated by a palmar ridge. The medial and lateral surfaces, in turn, are separated from the dorsal aspect by medial and lateral interosseous ridges. The dorsal surface is broad and narrows proximally serving for attachment of the extensor tendons of the index finger. Due to the oblique course of the medial interosseous ridge, the term metacarpal 2 ridge is used (Matshes *et al.* 2005).

The lateral surface provides attachment for the medial head of the first dorsal interosseous muscle while the medial surface gives rise to the second palmar interosseous ventrally and the second dorsal interosseous dorsally (Stack 1962). Although the position of the nutrient foramen is said to vary, it has been suggested that it is always directed proximally (Scheuer & Black 2000) or on the anteromedial and anterolateral surfaces (Patake & Mysorekar 1977). While variations of bony features are known to exist, terminologies used to describe the location of these variations also differ.

In the present study, a dorsal view of the right (R) second metacarpal (Figure 2a) was captured in such a way to illustrate that the proximal end of the shaft is twisted around its longitudinal axis. In this way, two oblique ridges can be seen running across the dorsal aspect of the shaft, namely, the distal oblique dorsal ridge (3) and proximal oblique dorsal palmar ridge (5). The distal oblique dorsal ridge is restricted to the dorsal surface while the proximal oblique dorsal palmar ridge runs from the dorsal to the palmar surface. The distal oblique dorsal ridge runs from the relatively short medial margin in a proximal direction where it terminates at a central point above the base. The dorsal aspect has two surfaces, namely, dorsal lateral (10) and dorsal medial (4). The dorsal lateral surface is rough compared to the smooth dorsal medial surface. It is assumed that the medial and lateral margins observed in the present study are the medial and lateral interosseous ridges mentioned by Scheuer and Black (2000). The medial oblique ridge reported by Matshes *et al.* (2005) relates to the distal oblique dorsal ridge (3) which is an extension of the medial margin.

A palmar view of the second metacarpal (Figure 6.2b), shows a central palmar tubercle (17) at its distal end. A shallow depression is located distal to this tubercle. The central palmar tubercle continues proximally as the central palmar ridge (19) which deviates medially. Three surfaces are present from this view, namely, palmar lateral (18), distal palmar medial (22) and proximal palmar medial (6). The deviation of the central palmar ridge medially increases the relative surface area of the palmar lateral surface.

From a lateral view (Figure 6.2c) the shaft is smooth. Both the palmar lateral (18) and dorsal lateral surfaces (10) can be seen. The palmar surface is concave while the dorsal

surface is convex as is reported in the literature. The central palmar tubercle (17) is seen as a bony prominence at the distal end.

The rotation of the proximal half of the shaft is clearly visible from a medial view (Figure 6.2d). Two ridges are present, namely, distal oblique dorsal ridge (3) and proximal oblique dorsal palmar ridge (5). Three surfaces can be identified, namely, dorsal lateral (10), palmar medial (22) and proximal palmar medial (6).

### **6.3.3 Head (Figures 6.2a-e)**

The head is described as being smooth and round (Romanes 1991). Two tubercles associated with the head are mentioned in the literature, although they are not named (Romanes 1991). The head of the second metacarpal in the juvenile hand is described as asymmetrical. This asymmetry is due to the large attachment site of the metacarpophalangeal ligament in the juvenile (Scheuer & Black 2000). The ridge connecting the two palmar tubercles of the head has been called the palmar articular margin (Romanes 1991). Romanes (1991) described the extension of the head as being much greater on the palmar than on the dorsal aspect which allows for greater flexion at this site. This feature was also observed in the present study.

In the present study, the shape and bony landmarks present on the head was different from various views. For this reason, the discussion will center around the dorsal, palmar, medial, lateral and superior views.

Not much of the head is visible dorsally (Figure 6.2a). This is because a relatively greater part of the head projects in a palmar direction. The head does appear to be round as mentioned in the literature. At the junction line where the head is demarcated from the shaft, two tubercles are found which are not mentioned in the literature, namely, dorsal medial (2) and dorsal lateral (9) tubercles. The former may in some cases be positioned more distally than the latter, but this varies. Another variation is that an elongated region may be found between these tubercles and the head, which has been called the neck (8) in the present

study. The relative length of the neck varied in the samples of the present study as seen in Figure 6.2a. In this figure, the neck is elongated in the right (R) and shortened in the left (L) second metacarpal (Figure 6.2a). This difference in relative length of the neck was observed more frequently in right hands, possibly indicating that it has to do with right or left handedness.

A relatively greater surface area of the head can be seen from a palmar aspect (Figure 6.2b). The head is not only tilted forward, but two extensions are present on either side of the head. These extensions, which project proximally, are referred to as the palmar lateral (16) and palmar medial (15) tubercles connected to each other by palmar articular margin (14). The palmar lateral tubercle is relatively larger and flares out more laterally than the palmar medial tubercle which is relatively smaller and projects proximally.

Nutrient foramina, when present, were located in the shallow concavity just proximal to the palmar articular margin (14).

The tilting of the head forward is clearly seen from a lateral view (Figure 6.2c). Two tubercles can be identified, namely, the dorsal lateral (9) and the palmar lateral (16) tubercles separated from each other by a lateral fossa (24).

A medial view of the head also shows the tilting (Figure 6.2d). The tubercles that can be identified are the dorsal medial (2) and palmar medial (15) tubercles separated by the medial fossa (28).

A superior view (Figure 6.2e) shows a smooth rhomboidal-shaped head. The head has relatively greater length laterally than medially. The lateral tubercles are more prominent than the medial tubercles. The lateral fossa (24) separating the dorsal lateral tubercle (9) from the rest of the head is easily identified.

#### **6.3.4 Base (Figures 6.2a-d and f)**

The base is sometimes referred to as the carpal (Bass 1995) or proximal end of the shaft. Matshes *et al.* (2005) listed the presence of nodular eminences on the lateral and medial

styloid processes which are for articulation with the trapezium and capitate carpal bones respectively, as key features for purposes of identification. They described the base as “pivot” or “wedge-shaped”. Gray (1932) describes the inferior facet as a medial facet identified at the tip of a long, narrow ridge. It is assumed that this ridge is the proximal medial articulating margin that distinguishes the two medial articulating facets from the inferior facet in the present study. Gray (1959) describes the four articular facets of the base as follows “Of the facets on the upper surface the intermediate is the largest and is concave from side to side, convex from before backward for articulation with the lesser multangular; the lateral is small, flat and oval for articulation with the greater multangular; the medial, on the summit of the ridge, is long and narrow for articulation with the capitate. The facet on the ulna side, articulates with the third metacarpal” (p. 255).

In reviewing the literature, a more detailed description of the base was found for the juvenile hand as given by Scheuer and Black (2000). Unfortunately, most of the key features listed by them are not depicted in their diagrams. These authors also identified the presence of a deep groove that accommodates the dorsal palmar inclination of the trapezoid. This groove is given the number 32 in the present study (Figure 6.2f). These authors describe the lateral and medial edges as extensions of this deep groove with the medial edge being much longer for articulation with the capitate. They noted the presence of a small quadrilateral facet on the lateral aspect of the base which articulates with the trapezium. This facet is numbered 25 in the present study (Figure 6.2f). On the dorsal aspect they report the presence of lateral and medial tubercles for attachment of the extensor carpi radialis longus and brevis respectively. In the present study, these tubercles were called the lateral (12) and medial (13) styloid processes. These authors also describe the position of the lateral tubercle immediately behind the quadrilateral facet (25) on the dorsal surface. Scheuer and Black (2000) also describe a lateral inclination on the palmar aspect of the base for the attachment of the flexor carpi radialis tendon. The attachment of the oblique head of adductor pollicis they state would be on the medial side on the palmar aspect. The medial side of the base they confirm articulates via a strip-like facet with the base of the third metacarpal. This strip-like facet is often identified as

2 individual facets in the adult hand where it is called the facet for metacarpal 3 (Matshes *et al.* 2005). These authors suggest that the constriction in the centre of the strip-like facet is presumably due to the interosseous ligament. This constriction is numbered 29 in the present study. A more comprehensive study of the base in the adult similar to that described for the juvenile hand by Scheuer and Black (2000) was not found.

Key features of a dorsal view of the base (Figure 6.2a) include a relatively longer medial (13) and a relatively shorter lateral (12) styloid process separated by a deep dorsal groove which continues onto the base (32).

From a palmar aspect (Figure 6.2b), the lateral end of the base extends further proximally than the medial end. The palmar articular margin is not as elevated as that on the dorsal surface. An oval-shaped articular facet is seen on the lateral surface (20).

A lateral view (Figure 6.2c) of the base shows the lateral styloid process (12) as well as parts of the medial styloid process (13). The lateral articular margin (26) is horizontally positioned.

The base from a medial view (Figure 6.2d) presents with a convex articular margin (31). Distal to this articular margin is an articular facet (30) with an adjacent interarticular fossa (29). Two instead of one facet may sometimes be present on the medial aspect.

The base is triangular in shape when seen from the articulating surface (Figure 6.2f). The descriptions of the base as given for the juvenile hand by Scheuer and Black (2000) are also identified in the present study. The only other additional landmark provided, is the lateral articular surface (27).

### **6.3.5 Siding**

In order to differentiate the right second metacarpal from the corresponding one on the left side, most authors orientated the bone in such a way that the palmar surface faces down and the dorsal surface faces up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2005).

For the purpose of the present study, a list of bony landmarks for the shaft, head and base of the second metacarpal will now be provided. This is to overcome any problems that may be encountered if only a fragment of the second metacarpal is found amongst skeletal remains.

### Shaft

1. Distal oblique dorsal ridge of the shaft (3) (Figure 6.2a)
2. Two surfaces can be identified on the dorsal aspect, namely, a relatively larger dorsal medial (4) and a relatively smaller dorsal lateral (10) surface (Figure 6.2a)
3. Proximal half of shaft rotated or twisted from medial to lateral (Figure 6.2a)
4. Central palmar tubercle (17) located distally (Figure 6.2b)
5. Central palmar ridge (23) deviates medially in the proximal third (Figure 6.2b)

### Head

1. Two palmar tubercles, namely, dorsal medial (located more distally) (2) and dorsal lateral (located more proximally) (9) (Figure 6.2b)
2. Two palmar tubercles, namely, a relatively smaller palmar medial (15) and a relatively larger palmar lateral (16) (Figure 6.2b)
3. Rhomboidal-shaped from a superior view with greater length laterally than medially (Figure 6.2e)
4. From a superior view, the dorsal lateral tubercle (9) is relatively larger and flares to the side to a much greater extent than the dorsal medial tubercle (16) (Figure 6.2e)

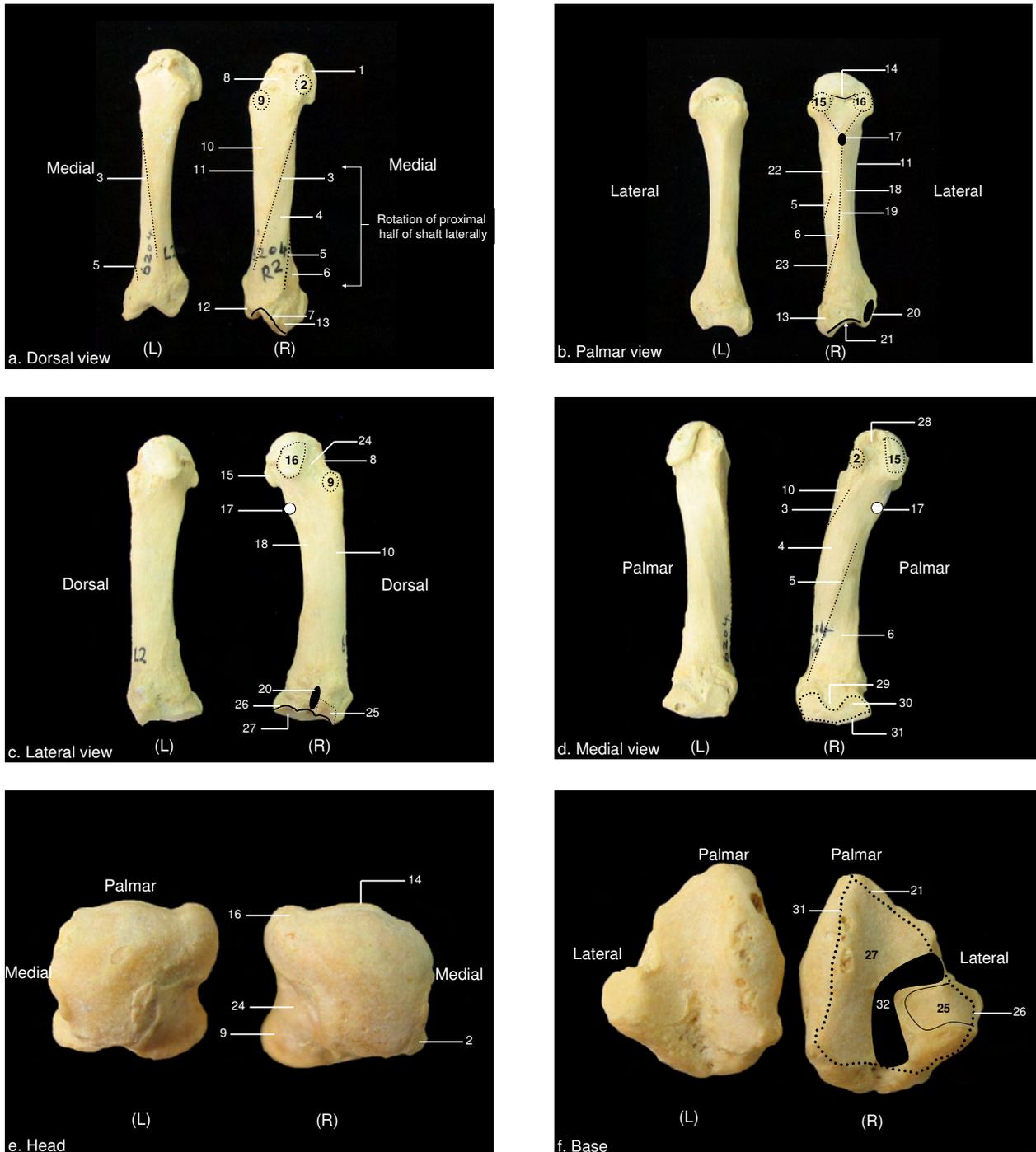
### Base

1. Longer medial styloid process (13) (Figure 6.2a)
2. Dorsal articular margin elevated or raised (7), resulting in a relatively longer medial styloid process (13) and a relatively shorter lateral styloid process (Figure 6.2a)
3. Palmar articular margin less elevated or almost horizontal (21) which slopes to merge with the medial styloid process (Figure 6.2b)
4. Larger bi-concave articular facet medially (27) (Figure 6.2f)



5. Triangular in shape as seen from the articulating surface, with the base at the dorsal end and the apex of the triangle at the palmar end. The articular margin which forms the medial boundary of this triangle (31) is straight compared to the curved lateral articular margin (Figure 6.2f)
6. Quadrilateral articular facet (25) relatively smaller than lateral facet as seen from the articulating surface (Figure 6.2f)
7. Small quadrangular facet (25) located laterally and overlapping onto the lateral surface (Figure 6.2f)
8. Relatively small facet (20) located laterally which is absent on the medial aspect of the base (Figure 6.2c)

Figure 6.2: Morphology of the right (R) and left (L) second metacarpal



1=medial fossa, 2=dorsal medial tubercle, 3= distal oblique dorsal ridge, 4= dorsal medial surface, 5=proximal oblique dorsal palmar ridge medially, 6= proximal palmar medial surface, 7=dorsal articular margin, 8=neck, 9= dorsal lateral tubercle, 10=dorsal lateral surface, 11=medial margin of shaft, 12=lateral styloid process, 13=medial styloid process, 14=palmar articular margin of head, 15= palmar medial tubercle, 16=palmar lateral tubercle, 17= central palmar tubercle, 18=palmar lateral surface, 19= central palmar ridge, 20=lateral articular facet, 21=palmar articular margin, 22=distal palmar medial surface, 23=medial deviation of central palmar ridge, 24=lateral fossa, 25= quadrilateral facet, 26= lateral articular margin of base, 27=medial articular facet of base, 28=medial fossa, 29=interarticular fossa, 30=medial articular facet of the base, 31=medial articular margin of base, 32=interarticular ridge of base

## 6.4 Morphology of the third metacarpal (Figures 6.3a-f)

### 6.4.1 Introduction

The third metacarpal is a bone associated with the middle finger. This unique central position is said to increase the functional efficiency of this bone as a stabiliser during various movements (Scheuer & Black 2000). With regards to the morphology of this bone, the literature provides brief descriptions (Bass 1995). Most of these list soft tissues associated with this bone rather than specific bony landmarks. For example, Gray *et al.* (1932) describe the attachment of the ulnar head of the second dorsal interosseous muscle and radial head of the third dorsal interosseous muscle to the radial and ulna side of the shaft respectively.

A description of the shaft, head and base of the third metacarpal as observed from a dorsal, palmar and lateral, medial view in the present will be discussed. This will be in conjunction with bony landmarks already mentioned in the literature.

### 6.4.2 Shaft or body (Figures 6.3a-d)

On a dorsal view (Figure 6.3a) the shaft is noticeably wider distally in comparison to the narrowed proximal end. Two ridges can be identified on the dorsal surface, namely, the dorsal medial ridge (2) and dorsal lateral ridge (11). These ridges converge towards the center of the shaft in the proximal third. Three surfaces associated with these ridges are identified as the dorsal medial (4), dorsal (3) and dorsal lateral (12) surfaces. The dorsal surface is rough and serves for attachment of the extensor tendon in comparison to the smooth lateral and medial surfaces which serve for attachment of the second and third dorsal interosseous muscle (Matshes *et al.* 2005).

The shaft, as observed from a palmar aspect (Figure 6.3b), also shows a broader distal and narrowed proximal end. The palmar surface is smooth throughout its entire length. The lateral margin forms an angle at the proximal and distal ends giving this margin a concave shape. The medial margin, on the other hand, is straight. A central palmar ridge (16) serves for attachment of the transverse head of adductor pollicis in the distal third (Matshes *et al.* 2005).

Two surfaces are found on either side of the central palmar ridge namely the palmar lateral (15) and palmar medial (22) surfaces for attachment of the second and third dorsal interosseous muscle (Matshes *et al.* 2005). In the midshaft, this ridge splits into two, namely, the palmar medial ridge (23) and palmar lateral ridge (17) which surrounds a third surface called the proximal palmar surface (18).

From a lateral view (Figure 6.3c), the shaft is smooth. The dorsal surface is straight in comparison to the palmar surface which is concave. Nutrient foramina are reported to occur on the lateral aspect of the shaft (Patake & Mysorekar 1977).

Features from a medial view (Figure 6.3d) are very similar to that seen on a lateral view with regards to the dorsal and palmar surfaces. What is noticeable from this view is that the proximal palmar surface (18) overlaps onto the medial surface.

#### **6.4.3 Head (Figures 6.3a-e)**

Not much of the head can be seen from a dorsal view (Figure 6.3a). This is because the head is tilted forward on the shaft. On either side of a line joining the head with the shaft, are two tubercles, namely, the dorsal lateral (10) and dorsal medial (1) tubercles. A ridge of bone extending from each tubercle joins distally and becomes concave in shape. The palmar lateral tubercle (9) can be seen from this view because of the greater width of the head on the palmar aspect. Between the dorsal lateral and palmar lateral tubercles is a shallow concavity, the lateral fossa (8).

The head also presents with two tubercles on a palmar view (Figure 6.3b). These are called the palmar lateral (9) and palmar medial (21) tubercles. The palmar lateral tubercle is relatively larger, longer and tends to flare outwards and proximally much more than the palmar medial tubercle, which is relatively smaller and shorter. These tubercles are connected to each other by a ridge of bone, also referred to as the palmar articular margin (20). A shallow rough depression is found in the area between these tubercles and the central palmar tubercle.

A lateral view (Figure 6.3c) shows a relatively larger and longer palmar lateral tubercle (9) as opposed to a relatively smaller and shorter dorsal lateral tubercle (10) separated by a lateral fossa (8). The palmar lateral tubercle is more distally positioned in relation to the dorsal lateral tubercle.

The medial view (Figure 6.3d) is similar to the lateral view with exception of the terminologies used. The dorsal medial (1) and palmar medial (21) tubercles are separated from each other by a medial fossa (33).

The head is square in shape from a superior view (Figure 6.3e). The tubercles on the dorsal and palmar aspect can be identified. The dotted line on this figure illustrates the relatively greater palmar width in comparison to the narrower dorsal width.

#### **6.4.4 Base (Figures 6.3a-d and f)**

The base presents with a lateral styloid process (13) (Matshes *et al.* 2005) from a dorsal view. Gray (1932) describes the base as follows “A pyramidal eminence is present on the lateral side of the dorsal part of its base and is termed the styloid process” (p. 342). Distal to the styloid process, is a rough area, referred to as a tubercle in third metacarpals of the juvenile hand (Scheuer & Black 2000), which serve as attachment for extensor carpi radialis brevis (Gray 1932). Scheuer and Black (2000) refer to the attachment of extensor carpi radialis brevis to a tubercle on the dorsal lateral aspect. In the present study this was found to be distal to the lateral styloid process (13). Lin and Cardenas (2003) reported that the brachioradialis may attach to the dorsal aspect of the base just deep to extensor carpi radialis brevis. In the present study, this region is located between the styloid process laterally (13) and the smaller medial tubercle (6). The medial tubercle of the base serves for attachment of the interosseous ligament (Scheuer & Black 2005).

In the present study, the base presents with a prominent bony extension which is referred to as the palmar baseplate (19) as seen from a palmar view (Figure 6.3b). This bony projection is directed medially which explains the irregular convex shape of the articulating facet. Due to this deviation, the lateral styloid process can also be identified in the background.

In the present study a lateral view (Figure 6.3c) of the base was seen to present with two facets rather than a single “strip-like” facet (Scheuer & Black 2005). Both the dorsal (27) and palmar (26) lateral facets are convexed distally. A shallow depression (25) is located distal to the constricted point where the two facets meet. The lateral aspect of the base is smooth and has a concave facet for articulation with the second metacarpal (Gray 1932, Matshes *et al.* 2005). It is said that the lateral facet is constricted in the midline as it serves for attachment of the interosseous ligament (Scheuer & Black 2005).

The medial aspect of the base (Figure 6.3f) has two oval facets for articulation with the lateral aspect of the base of the fourth metacarpal (Scheuer & Black 2000). It is said that the palmar facet (31) located medially on the base occurs less frequently and in some cases may even be absent (Scheuer & Black 2000). The other facet was referred to as the dorsal facet located medially (30).

A rectangular-shaped base is clear from an inferior view (Figure 6.3f). The dotted line on this figure illustrates the relatively longer dorsal width represented by the dorsal articular margin (7) in comparison to the narrower palmar width represented by the palmar articular margin (24). The proximal articular facet on the base is concaved dorsally (Gray 1932, Scheuer & Black 2000) where it becomes continuous with the lateral styloid process and convex on the palmar aspect (Scheuer & Black 2000). The proximal facet articulates with the capitate (Gray 1932, Matshes *et al.* 2005, Scheuer & Black 2000), proximal phalanx, second and third metacarpals (Matshes *et al.* 2005).

#### **6.4.5 Siding**

In order to differentiate the right third metacarpal from the corresponding one on the left side, the bone is orientated with the palmar surface facing down and the dorsal surface facing up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2005).

For the purpose of the present study, a list of bony landmarks for the shaft, head and base of the third metacarpal will now be provided. This is to overcome any problems that may be encountered if only a fragment of the third metacarpal is found amongst skeletal remains.

#### Shaft

1. Palmar medial ridge (23) extending more medially (Figure 6.3b)
2. Proximal palmar surface (18) deviates medially (Figure 6.3b)

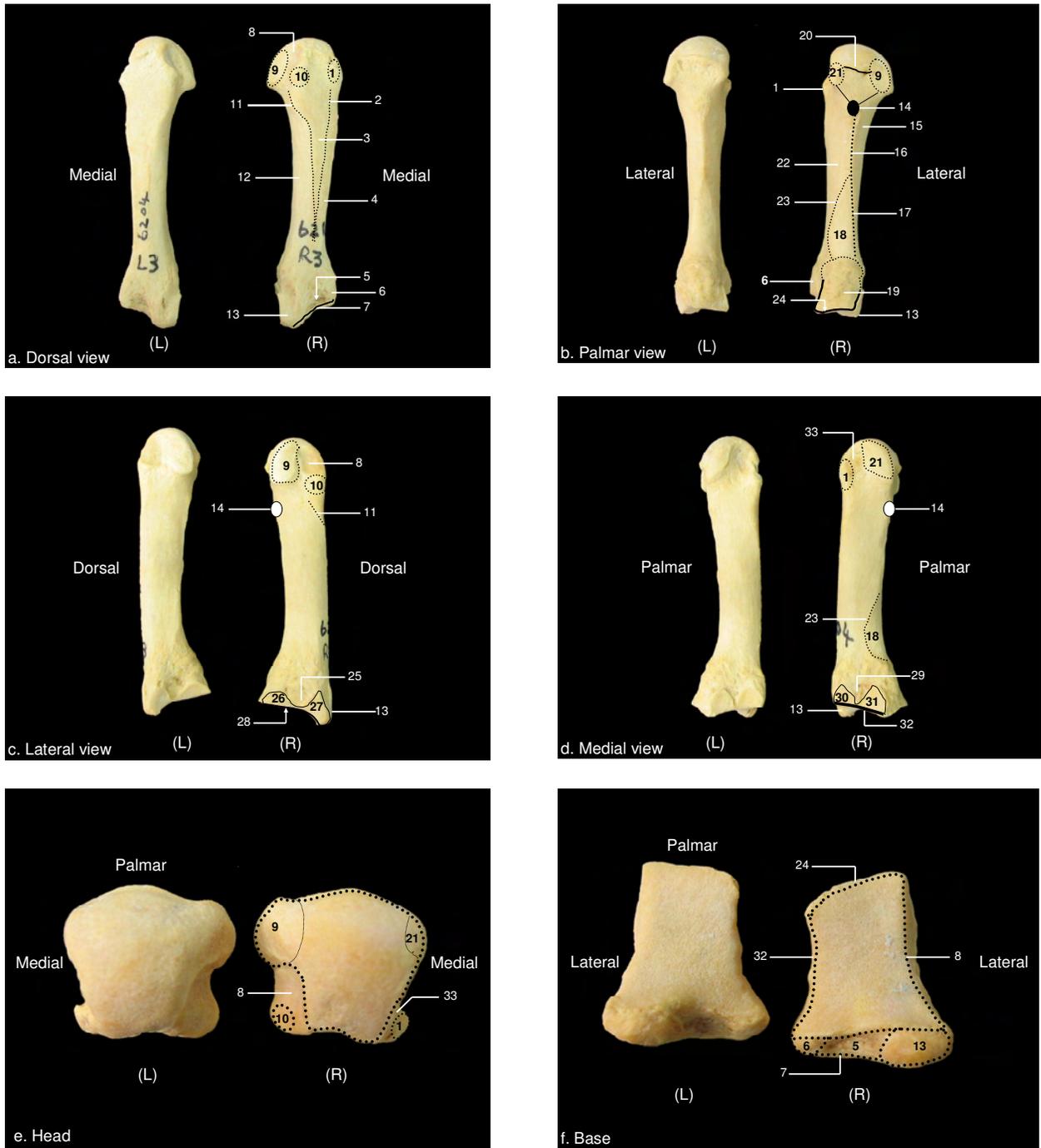
#### Head

1. Palmar lateral tubercle (9) longer and flares outwards and proximally (Figure 6.3b)
2. Lateral fossa (8) deeper and relatively bigger than medial fossa (33) (Figures 6.3c and d)
3. Head is wider on the palmar than on the dorsal aspect (Figure 6.3e)

#### Base

1. Longer styloid process located laterally (13) (Figure 6.3a)
2. Palmar foot plate directed medially (19) (Figure 6.3b)
3. Lateral articular margin concave (28) (Figure 6.3c)
4. Medial articular margin oblique (32) (Figure 6.3d)
5. While the base is approximately rectangular in shape as seen from the articulating surface, it is relatively wider dorsally than on the palmar aspect (Figure 6.3f)

Figure 6.3: Morphology of the right (R) and left (L) third metacarpal



1=dorsal medial tubercle of head, 2=dorsal medial ridge, 3=dorsal surface of shaft, 4=dorsal medial surface of shaft, 5= dorsal concavity of base, 6=dorsal medial tubercle of base, 7=dorsal articular margin of base, 8=lateral fossa of head, 9=palmar lateral tubercle of the head, 10=dorsal lateral tubercle of the head, 11=dorsal lateral ridge, 12=dorsal lateral surface of shaft, 13=styloid process, 14=central palmar tubercle, 15=palmar lateral surface, 16= central palmar ridge, 17=lateral palmar ridge, 18=proximal palmar surface, 19=palmar baseplate, 20=palmar articular margin of head, 21=palmar medial tubercle, 22=palmar medial surface, 23=medial palmar ridge, 24=palmar articular margin of base, 25=lateral interarticular fossa of base, 26=dorsal articular facet of base located laterally, 27=palmar articular facet of base located medially, 28=lateral articular margin of base, 29=medial interarticular fossa of base, 29=dorsal articular facet of base located medially, 30=palmar articular facet of base located medially, 32=medial articular margin of base, 33=medial fossa of head

## 6.5 Morphology of the fourth metacarpal (Figures 6.4a-f)

### 6.5.1 Introduction

The fourth metacarpal is described as a miniature (Romanes 1991), long (Bass 1995, Romanes 1991), cylindrical (Bass 1995) bone aligned with the ring finger. This bone is relatively short, (Bass 1995, Matshes *et al.* 2005) slender, (Scheuer & Black 2000) and more gracile (Matshes *et al.* 2005) when compared to the second and third metacarpals. It is, however, relatively longer than the first and fifth metacarpal. The fourth metacarpal articulates with adjacent third and fifth metacarpals, the proximal phalanx distally, the capitate and hamate proximally (Gray 1959, Matshes *et al.* 2005, Romanes 1991). In some textbooks, brief summaries of general features for all metacarpals are given (Hal-Griggs 1985, Moore & Agur 2002). El-Najjar and McWilliams (1978) provide diagrams of the hand but the metacarpals, including the fourth one, are not labelled.

### 6.5.2 Shaft or body (Figures 6.4a-d)

The shaft is triangular in cross section (Bass 1995, Hollinshead & Rosse 1985) The smooth dorsal surface is broad distally and narrows at the proximal end (Figure 6.4a) In the distal third, the medial (4) and lateral (9) margins run in an oblique manner proximally towards the center of the shaft and merges at a point just distal to the base. Three surfaces can be identified on the dorsal aspect, namely, dorsal medial (5), dorsal (6) and dorsal lateral (10) surfaces.

The palmar surface is concave (Bass 1995, Hollinshead & Rosse 1985) and interrupted by a centrally located palmar ridge (24) (Figure 6.4b). The presence of this ridge creates two surfaces, namely, palmar lateral (18) and palmar medial (25) surfaces. Although the presence of a ridge is recorded in the literature, it does not state whether it is on the dorsal or palmar surface (Scheuer & Black 2000, Matshes *et al.* 2005). Muscle attachments associated with the palmar surfaces are commonly described or labeled on diagrams. For example, the third palmar interosseous and medial head of the third dorsal interosseous muscles attach to the

lateral surface (Scheuer & Black 2000) The medial surface of the shaft, on the other hand, is reserved for attachment of the lateral head of the fourth dorsal interosseous muscle (Scheuer & Black 2000). A nutrient foramen has been identified at the proximal end (Bass 1995) of the lateral surface of the shaft (Scheuer & Black 2000). The shape of the lateral and medial margins as seen from both the dorsal and palmar views, is concave with the medial margin extending further proximally than the lateral margin.

From a lateral view (Figure 6.4c), the dorsal lateral margin (9) extends proximally from the dorsal lateral tubercle (2) and in the midshaft region, it runs across to the dorsal surface. The palmar lateral margin (17) runs proximally and ends at the proximal tuberosity of the shaft (27).

From a medial view (Figure 6.4d), the dorsal medial margin (4) runs from the dorsal medial tubercle (3) to the midshaft region where it then crosses over to the dorsal aspect of the smooth shaft, similar to that observed for the dorsal lateral margin (9). A rough articular surface (30) presents proximally just above the base on the medial surface. The palmar articular margin is straight (31).

### **6.5.3 Head (Figures 6.4a-e)**

The head or distal extremity of the shaft (Bass 1995) articulates with the base of the proximal phalanx (Scheuer & Black 2000). It is large and round (Bass 1995) with the distal articulating margin convex distally (1). The tilting of the head forward on the shaft may allow for greater flexion than extension at this joint. This forward angulation thus results in a relatively smaller area of the head being visible from a dorsal view (Figure 6.4a). In fact, the head is said to be asymmetrical which allows the fingers to roll into the palm of the hand forming a clenched fist (Bass 1995). Scheuer and Black (2000) describe the head of the fourth metacarpal in juveniles as symmetrical (Scheuer & Black 2000).

The greater surface area of the head visible on a palmar view (Figure 6.4b), also presents with two tubercles. The palmar lateral (16) and palmar medial (15) tubercles are separated from each by a shallow depression. The palmar medial tubercle is directed more

outwards or medially while the palmar lateral tubercle points proximally. The palmar articular margin of the head (14) merges with each tubercle on the sides.

A relatively smaller dorsal lateral tubercle (2) and relatively larger palmar lateral tubercle (16) can be seen on a lateral view (Figure 6.4c). A shallow fossa (26) is located between the two tubercles.

On a medial view (Figure 6.4d) a relatively smaller dorsal medial tubercle (3) and a relatively larger palmar medial tubercle (15) can be seen. A medial fossa (29) separates the two medial tubercles.

The head is rhomboidal in shape as seen from a superior view (Figure 6.4e). The palmar width is greater than the dorsal width. The head is asymmetrical as is seen by the medial deviation of the dorsal margin, resulting in the dorsal lateral tubercle (2) being prominent.

#### **6.5.4 Base (Figures 6.4a-d and f)**

The base of the fourth metacarpal is identified as an irregular expansion at the proximal end of the shaft (Hall-Craggs 1985.) This feature allows it greater approximation and thus reduced mobility at the carpo-metacarpal joint (Hall-Craggs 1985). Matshes *et al.* (2005) state that descriptions of facets for articulation with the hamate, third and fifth metacarpals are easily identified bony landmarks. Gray (1973) refers to the presence of a facet and tubercle on the radial and ulna side of the base for articulation with the fifth and third metacarpal respectively.

At the proximal end of the dorsal surface (Figure 6.4a), a relatively small, elongated lateral tubercle (11) forms a sharp point as it runs proximally. On the medial side, the bone which deviates outward is called the styloid process (7). A shallow depression (8) is found between the tubercle and the styloid process.

From a palmar view (Figure 6.4b) the base forms a rounded apex (21) with two articular facets located on its lateral and medial side, namely, palmar lateral articular facet (22) and palmar medial articular facet (20).

A lateral view (Figure 6.4c) shows the presence of two facets, namely, palmar lateral articular facet (22) and dorsal lateral articular facet (12). These articular facets are separated from each other by an interarticular groove (28).

The medial aspect of the base (Figure 6.4d) has a single, relatively large oval facet for articulation with the lateral aspect of the base of the fifth metacarpal (Scheuer & Black 2000).

The articular end of the base (Figure 6.4f) is irregular in shape. The medial articular facet is semilunar (32) in shape while the lateral half presents with two rounded articular facets, namely, the dorsal lateral (12) and palmar lateral (22) facets. Gray (1973) describes the proximal surface of the base as concavo-convex incorporating the entire surface.

### 6.5.5 Siding

In order to differentiate the right fourth metacarpal from the corresponding one on the left side, the bone is orientated with the palmar surface facing down and the dorsal surface facing up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2000).

For the purpose of the present study, a list of bony landmarks for the shaft, head and base of the fourth metacarpal will now be provided. This is to overcome any problems that may be encountered if only a fragment of the fourth metacarpal is found amongst skeletal remains.

#### Shaft

1. Styloid process located medially at the proximal end (7) (Figure 6.4a)
2. Central palmar ridge (24) runs its course from a central position at the distal end to the medial end of the shaft in the proximal third (Figure 6.4b)

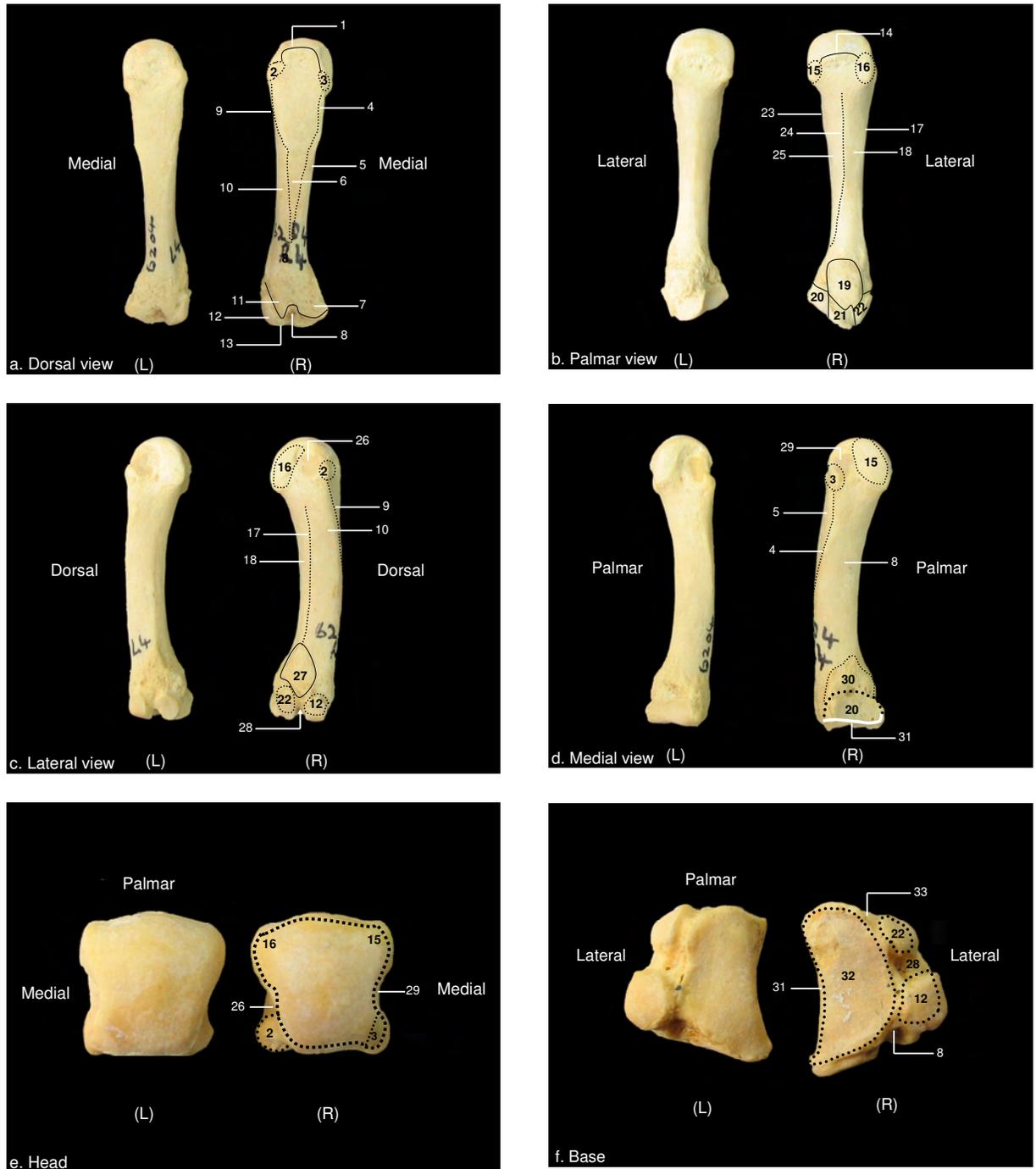
#### Head

1. Head is wider on the palmar than on the dorsal aspect with the latter deviating slightly medially (Figure 6.4e)
2. The dorsal margin of the head is directed laterally (Figure 6.4e)

Base

1. Long styloid process located medially (7) (Figure 6.4a)
2. Single articular facet medially (20) (Figure 6.4d)
3. Two articular facets laterally (12 & 22) (Figure 6.4c)
4. Medial articular margin slightly concave (31) (Figure 6.4d)
5. A view from the articular surface (Figure 6.4f):
  - a. There is a single medially located semilunar facet (32)
  - b. There are two laterally located round facets (12 & 22)
  - c. The dorsal lateral facet (12) is relatively larger than the palmar lateral facet (22)
6. Lateral articular margin interrupted by the interarticular groove (28) (Figure 6.4f)

Figure 6.4: Morphology of the right (R) and left (L) fourth metacarpal



1=dorsal articular margin of head, 2=dorsal lateral tubercle of head, 3=dorsal medial tubercle of head, 4=medial margin of shaft, 5=dorsal medial surface of shaft, 6=dorsal surface of shaft, 7=styloid process, 8=shallow depression of base on the dorsal surface, 9=lateral margin of shaft, 10=dorsal lateral surface of shaft, 11=lateral tubercle of base, 12=dorsal lateral articular facet of base, 13=dorsal articular margin of base, 14=palmar articular margin of head, 15= palmar medial tubercle of head, 16=palmar lateral tubercle of head, 17=palmar lateral margin of shaft, 18=palmar lateral surface of shaft, 19=proximal oval tuberosity on palmar surface of base, 20=medial articular facet of base on lateral surface, 21=proximal footplate of base on palmar surface 22=palmar lateral articular facet of base, 23=palmar medial margin of shaft, 24=central palmar ridge, 25=palmar medial surface of shaft, 26= lateral fossa of head, 27=proximal rectangular tuberosity on lateral surface of base, 28=interarticular groove, 29=medial fossa of head, 30=proximal rough area on medial surface of shaft, 31=medial articular margin of base, 32=lateral articular facet of base, 33=palmar articular margin of base

## **6.6 Morphology of the fifth metacarpal (Figures 6.5a-f)**

### **6.6.1 Introduction**

The fifth metacarpal is the most medially positioned digit in the hand. Its position in the hand dictates the number of articulating facets that it has. For example, it is identified by three articulating facets, namely, a facet on the lateral aspect of the shaft, a facet proximally for the hamate and a facet distally for the proximal phalanx. The medial aspect of the shaft has no articulating facets (Matshes *et al.* 2005).

Generally, the only reference made of the fifth metacarpal in the literature is the division into a head, shaft and base (Hollinshead & Rosse 1985). Sometimes, the fifth metacarpal is mentioned in terms of movement, where it is said to be the least mobile digit when compared to adjacent metacarpals (Hollinshead & Rosse 1985). On the other hand, descriptions of the fifth metacarpal in the juvenile hand, has received much more attention with regards to morphological detail (Scheuer & Black 2000). Descriptions of the adult hand as observed in the present study will be discussed below under the headings of shaft, head and base. The numbers in brackets adjacent to the bony landmark corresponds to the numbers on the appropriate diagrams.

### **6.6.2 Shaft or body (Figures 6.5a-d)**

The dorsal surface presents with an oblique (Gray 1959, Matshes *et al.* 2005), sometimes referred to as a linear (Matshes *et al.* 2005) ridge running from the medial side of the base (Gray 1959, Matshes *et al.* 2005) to the lateral end of the head (Gray 1959, Matshes *et al.* 2005). From the present study, a dorsal view (Figure 6.5a) shows the oblique ridge (6) starting distal to the medial tuberosity of the shaft (8) and running laterally across the shaft in a distal direction where it ends proximal to the dorsal lateral tubercle (3). On either side of the ridge are two surfaces, namely, a dorsal lateral (13) and dorsal medial (5) surface.

At the distal end of the palmar surface of the shaft (Figure 6.5b) is a prominent central palmar tubercle (17). Distal to this tubercle is a rough triangular region. Extending proximally

from this tubercle is a central palmar ridge (23). Two surfaces can also be seen on either side of this ridge, namely, the palmar lateral (19) and palmar medial surfaces (22). At the proximal end of the shaft are the palmar lateral (7) and palmar medial (8) tuberosities of the shaft.

The lateral surface of the fifth metacarpal in the juvenile hand presents with a longitudinal ridge which divides this surface into a dorsal and palmar division (Scheuer & Black 2000). In the present study, (Figure 6.5c) the longitudinal ridge is labelled as the palmar lateral margin of the shaft (18). Most textbooks relate the attachments of the medial head (Scheuer & Black 2000), the fourth dorsal interosseous (Scheuer & Black 2000, Gray 1959) and extensor tendons (Gray 1959) to the lateral surface. Patake and Mysorekar (1977) identified nutrient foramina at the proximal aspect of the lateral surface.

The medial aspect of this surface has been described as being smooth (Gray 1959) and serves for attachment of opponens digiti minimi (Scheuer & Black 2000). A view of the medial aspect of the shaft in the present study (Figure 6.5d), shows the palmar medial margin of the shaft (21) extending from the proximal tuberosity (25) to the dorsal medial tubercle of the head (4) distally. The proximal end of the dorsal oblique ridge (6) can also be seen to merge with the palmar medial margin of the shaft (21) from this view.

### **6.6.3 Head (Figures 6.5a-e)**

The head or distal end of the fifth metacarpal, articulates with the base of the proximal phalanx (Gray 2005, Matshes *et al.* 2005). It is asymmetrical with a round articulating surface (Romanes 1991). Studies by Scheuer and Black (2000) on the juvenile hand ascribed this asymmetry to a “large attachment site” for the metacarpophalangeal ligament. Two tubercles occur on the head when observed from a dorsal view (Figure 6.5a), namely, the dorsal lateral (3) and dorsal medial (4) tubercles. Scheuer and Black (2000) state that although these tubercles appear to be the same distance from the joint surface, the lateral tubercle is more distally placed than the medial tubercle in the juvenile hand. This feature was also observed in the present study.

Tubercles similar to those observed on the dorsal surface are seen from a palmar aspect (Figure 6.5b). The palmar lateral tubercle (16) appears to project more proximally than the palmar medial tubercle (15). The literature describes the head as being larger on the palmar than on the dorsal aspect. The tendon of abductor digiti minimi attaches to the palmar medial aspect (Scheuer & Black 2000, Hubay 1949).

A relatively larger palmar lateral tubercle (16) is separated from a relatively smaller dorsal lateral tubercle (3) by a lateral fossa (12) seen from a lateral view (Figure 6.5c). When a medial view of the head is observed (Figure 6.5d), a relatively larger palmar medial tubercle (15) is separated from a relatively smaller dorsal medial tubercle (4) by a medial fossa (2) is seen.

From a superior view (Figure 6.5e) the head is rhomboidal in shape. The dorsal and palmar tubercles can be seen from this view.

#### **6.6.4 Base (Figures 6.5a-d and f)**

Matshes *et al.* (2005) mention the presence of two facets on the base, namely, one for the hamate and the other for the fourth metacarpal. Gray (1973), on the other hand, gives a more detailed description by stating that the base is concave-convex on its proximal surface. Some authors (Gray 1973, Scheuer & Black 2000) mention the facet and tubercle on the radial and ulna sides of the base for articulation with the fourth metacarpal and for attachment of the extensor carpi ulnaris muscle respectively. Gray (2005) tend to provide a general statement by mentioning that the base articulates with the carpal bones and with adjacent metacarpals. Hollinshead and Rosse (1985) describe the base as being flat. El-Najjar and McWilliams (1978) provide diagrams of the hand bones but the metacarpals, including the fifth, one are not labelled.

The dorsal articular margin (11) as seen from a dorsal view (Figure 6.5a), is concave distally, making the articular surface of the base visible from this view (10). The lateral articular facet (9) can be seen from a dorsal view due to rotation of the proximal end of the base in a medial direction.

The concave articulating margin (20) of the base as seen from a palmar view (Figure 6.5b), is at a lower level when compared to the dorsal articular margin.

From a lateral view (Figure 6.6c) the articular margin (24) is convexed proximally. Located distal to the articular margin is an oval-shaped articular facet (9). From a medial view (Figure 6.5d) the articular margin (26) is also convexed proximally. The proximal tuberosity of the shaft (25) is located distal to the medial articular margin.

The concave articular surface of the base (Figure 6.6f) is rectangular-shaped. The lateral margin (24) is relatively longer when compared to the relatively shorter medial margin (26).

### 6.6.5 Siding

In order to differentiate the right fifth metacarpal from the corresponding one on the left side, the bone is orientated with the palmar surface facing down and the dorsal surface facing up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2000).

For the purpose of the present study, a list of bony landmarks for the shaft, head and base of the fifth metacarpal will now be provided. This is to overcome any problems that may be encountered if only a fragment of the fifth metacarpal is found amongst skeletal remains.

#### Shaft

1. Dorsal oblique ridge (6) runs obliquely from the medial surface of the shaft proximally to the lateral surface of the shaft distally (Figure 6.5a)
2. Proximal third of the shaft is rotated laterally (Figures 6.5a and b)
3. Central palmar ridge (23) deviates medially in the proximal third (Figure 6.5b)

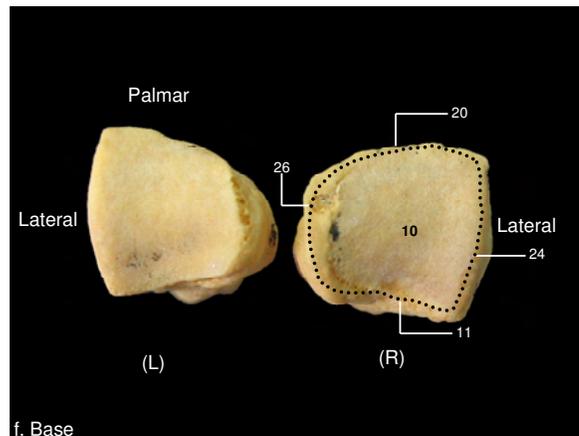
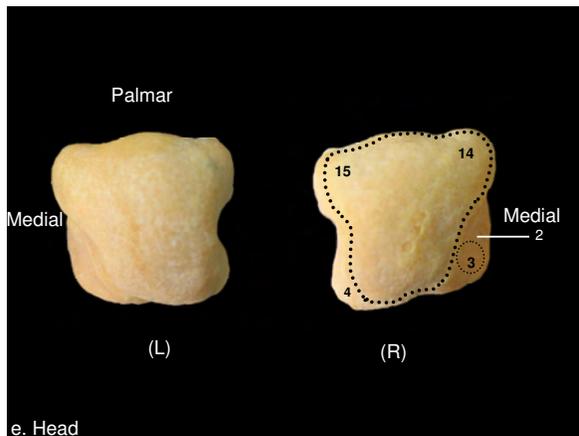
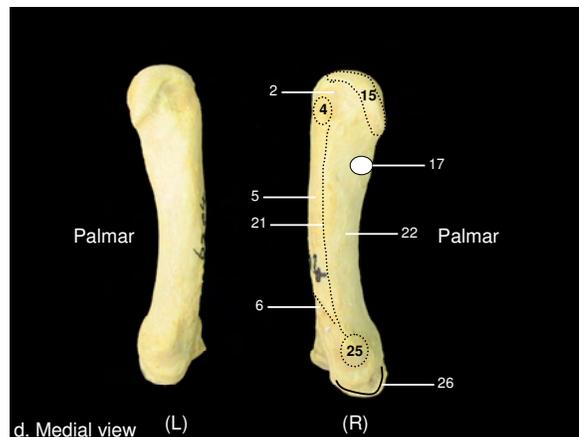
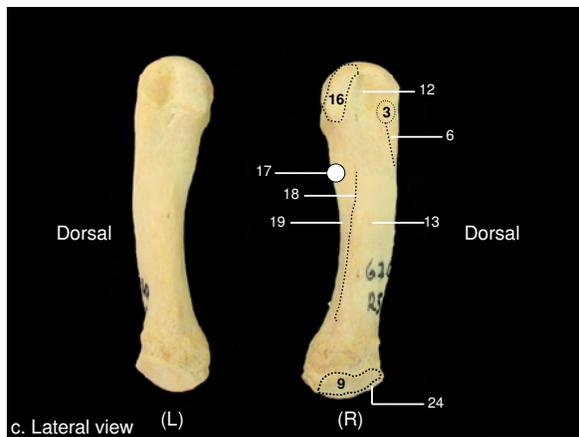
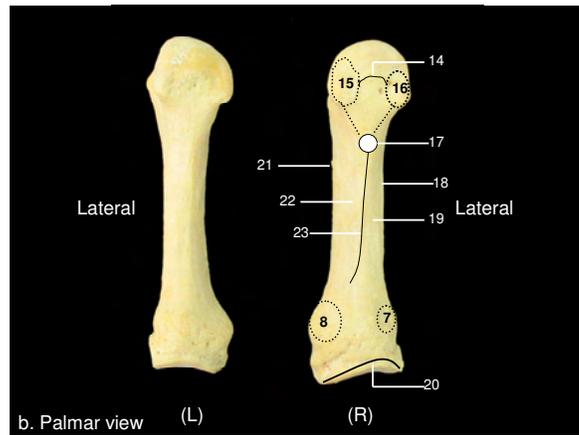
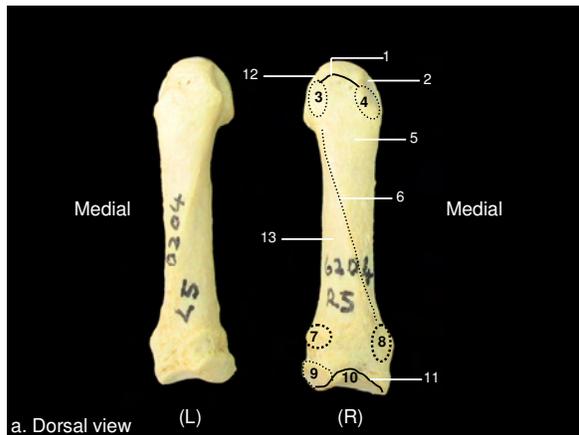
#### Head

1. Palmar medial tubercle (15) is relatively larger than the palmar lateral tubercle (16) (Figure 6.5b)

Base

1. The concavity of the dorsal articular margin (11) is set more distally than the palmar articular margin (20) (Figures 6.5a and b)
2. Articular margin of the base on the lateral surface is convexed proximally (24) (Figure 6.5c)
3. Articular margin of the base on the medial surface is rounded (26) (Figure 6.5d)
4. Absence of an articular facet on the medial aspect of the base (Figure 6.5f)

Figure 6.5: Morphology of the right (R) and left (L) fifth metacarpal



1=dorsal articular margin of head, 2=medial fossa of head, 3=dorsal lateral tubercle of head, 4=dorsal medial tubercle of head, 5=dorsal medial surface of shaft, 6=dorsal oblique ridge of shaft, 7=palmar lateral tuberosity of shaft, 8=palmar medial tuberosity of shaft, 9=lateral articular facet of base, 10=articular facet of base, 11=dorsal articular margin of base, 12=lateral fossa, 13=dorsal lateral surface of shaft, 14=palmar articular margin of head, 15= palmar medial tubercle of head, 16=palmar lateral tubercle of head, 17= distal palmar tubercle of shaft, 18=palmar lateral margin of shaft, 19=palmar lateral surface of shaft, 20=palmar articular margin of base, 21=palmar medial margin of shaft, 22=palmar medial surface of shaft, 23= central palmar ridge, 24=lateral articular margin of base, 25=proximal tuberosity on medial surface of shaft, 26=medial articular margin of base

## **6.7 Morphology of the first proximal phalanx (Figures 6.6a-f)**

### **6.7.1 Shaft or body (Figures 6.6a-d)**

From a dorsal view (Figure 6.6a) the shaft is smooth along its entire length and also wider at the proximal than at the distal end. The lateral margin (10) has a deeper concavity than the medial margin (4). The tilting of the base laterally causes the lateral margin to project further proximally than the medial margin. Where the shaft joins the base, an inverted-V margin is formed (5).

From a palmar view (Figure 6.6b), the proximal half of the shaft is rotated laterally and the distal half rotated medially. This rotation results in the lateral margin projecting forward. The palmar surface is concave from proximal to dorsal. A shallow depression is evident in the distal third (19). Numerous nutrient foramina can be identified in the proximal third (15).

The shaft in the proximal two-thirds is broad and becomes narrow at the distal end when observed from a lateral view (Figure 6.6c). Scheuer and Black (2000) describe the distal end of the shaft as tapered. Nutrient foramina can be identified at the proximal end of the lateral surface. The proximal two-thirds of the palmar surface of the shaft can be seen from a lateral view due to rotation of the shaft laterally. The dorsal surface is flat while the palmar surface is concave.

The medial margin, when observed from a medial view (Figure 6.6d), presents with a steeper slope than the lateral margin. The palmar surface is not visible from the medial aspect.

### **6.7.2 Head (Figures 6.6a-e)**

A dorsal view (Figure 6.6a) shows a relatively small surface area of the head. This is because the head projects more in a palmar than in a dorsal direction. A distinct dorsal articular margin (1) can be seen separating the head from the distal end of the shaft. The rotation of the distal end of the shaft medially causes a simultaneous rotation of the head in the same direction, thus exposing more of the medial fossa (3) than the lateral fossa (9). Although the articular surface, which forms a joint with the base of the middle phalanx is concave, it

tends to tilt more on the medial than on the lateral side. This tilting causes the lateral condyle (8) to be at a lower or more proximal level than the medial condyle (2).

A relatively larger surface area of the head can be seen from a palmar view (Figure 6.6b). The rotation of the head medially together with the distal end of the shaft is obvious. The lateral (8) and medial (2) condyles are convex distally and are separated from each by a shallow concavity. The medial condyle (2) is at a higher level than the lateral condyle (8) which is indicated on the diagram by the solid black line which depicts the inclination of the slope associated with each condyle. The palmar articular margin (14) is concave proximally.

From a lateral view (Figure 6.6c) the rotation of the head medially on the shaft is seen. The head is round in shape and surrounds the lateral fossa (9).

Features of the head from a medial view (Figure 6.6d), is similar to that observed from a lateral view. The medial condyle (2) surrounds the medial fossa (3). The rotation of the head medially enables one to identify both the lateral (8) and medial (2) condyles from this view.

From a superior view (Figure 6.6e) the head is rectangular in shape. The dorsal articular margin (1) is convex in shape compared to the concave palmar articular margin (14). The lateral condyle on the palmar surface is relatively bigger and projects more laterally than the relatively smaller medial condyle. This projection of the condyles outwards results in a longer palmar and shorter dorsal margin. The intercondylar groove (23) separates the two condyles.

### **6.7.3 Base (Figures 6.6a-d and f)**

From a dorsal view (Figure 6.6a), the lateral margin (11) of the base tilts proximally and has relatively greater height than the medial margin (6). The dorsal articular margin (7) is slightly concave proximally.

The base as viewed from a palmar aspect (Figure 6.6b) is broad when compared to the rest of the bone. The medial articular margin (18) of the base is an irregular line which is horizontally positioned. Located distal to the palmar articular margin are the lateral (17) and medial (16) tubercles. The medial tubercle is relatively larger than the lateral tubercle. The

lateral rotation of the proximal end of the shaft causes a simultaneous rotation of the base in the same direction.

From a lateral view (Figure 6.6c) the articulating margin (21) tends to slope from the proximal end of the dorsal surface to the lateral tubercle (17) on the palmar surface. A lateral articular facet (12) can be seen on the dorsal surface.

From a medial view (Figure 6.6d) the articulating margin (22) is fairly straight. The medial tubercle (16) occupies a large area at the proximal end of the palmar surface.

The articular surface of the base (Figure 6.6f) is oval in shape. The palmar tubercles are prominent with the palmar medial tubercle (16) relatively larger than the palmar lateral tubercle (17).

#### **6.7.4 Siding**

In order to differentiate the right first proximal phalanx from the corresponding one on the left side, the bone is orientated with the palmar surface facing down and the dorsal surface facing up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2000).

For the purpose of the present study, a list of bony landmarks on the shaft, head and base of the first proximal phalanx will now be provided. This is to overcome any problems that may be encountered if only a fragment of the first proximal phalanx is found amongst skeletal remains.

##### Shaft

1. Proximal end of lateral margin of shaft slopes more proximally (10) than medial margin (Figures 6.6a and b)
2. Lateral margin of shaft longer than the medial margin (Figures 6.6a and d)
3. Lateral margin of shaft has greater depth than medial margin (Figures 6.6a and d)
4. Proximal end of shaft rotated laterally (Figures 6.6a and b)

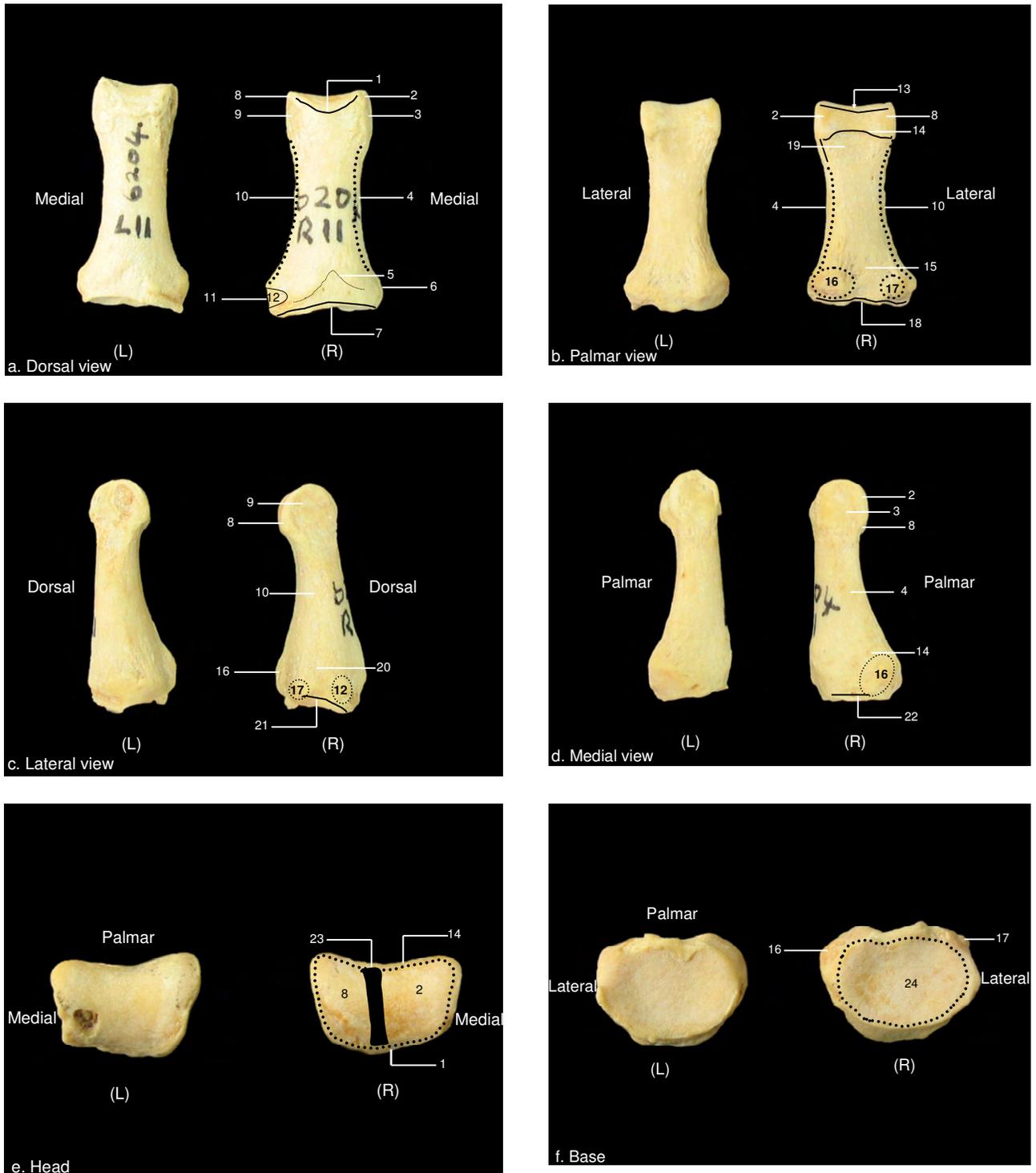
##### Head

1. Medial condyle (2) located more distal than the lateral condyle (8) (Figures 6.6a and b)
2. Surface area of medial condyle relatively smaller than lateral condyle (Figure 6.6e)
3. Lateral condyle projects more laterally than the medial condyle (Figure 6.6e)

Base

1. Medial margin of base tilted proximally (6) (Figure 6.6a)
2. Lateral margin tilted distally (11) (Figure 6.6a)
3. Dorsal articular margin slightly concave (7) (Figure 6.6a)
4. Palmar articular margin straight (18) (Figure 6.6b)

Figure 6.6: Morphology of the right (R) and left (L) first proximal phalanx (PP)



1=dorsal articular margin of the head, 2=medial condyle of head, 3=medial fossa of head, 4=medial margin of shaft, 5=inverted v-shaped space of shaft, 6=medial margin of base, 7=dorsal articular margin of base, 8=lateral condyle of head, 9=lateral fossa of head, 10=lateral margin of shaft, 11=lateral margin of base, 12=proximal dorsal lateral tubercle, 13=slope of articular surface of head, 14=palmar articular margin of head, 15=nutrient foramina on proximal palmar surface of shaft, 16=palmar medial tubercle of base, 17=palmar lateral tubercle of base, 18=medial articular margin of base, 19=distal concavity on palmar surface of shaft, 20=nutrient foramina on lateral surface of shaft, 21=lateral articular margin of base, 22=medial articular margin of base, 23=intercondylar groove, 24=articular facet of base.

## **6.8 Morphology of the second proximal phalanx (Figures 6.7a-f)**

### **6.8.1 Shaft or body (Figures 6.7a-d)**

Detailed analysis of the dorsal view (Figure 6.7a), indicated that the shaft of the second proximal phalanx is relatively longer than the corresponding bone of the thumb. It is also smooth along its entire length. The medial margin (4) is relatively straight along its entire length except for the proximal third where it tends to slope as it approaches the base. The lateral margin (10) is also straight and slopes just proximal to the midshaft region as it approaches the base. This results in the slope of the lateral margin being relatively longer than the slope of the medial margin. At the point where the lateral margin meets the base, a straight margin rather than a convex margin is formed when compared to the medial side.

In a palmar view (Figure 6.7b) the proximal end of the shaft seems to be slightly rotated in a lateral direction while the distal end does not appear to be rotated at all. This lateral rotation is slightly less than that observed in the corresponding bone of the thumb. The margins on either side of the shaft are rough, and referred to as the lateral (12) and medial (18) ridges. The lateral ridge is more prominent in comparison to the medial ridge. Close observation of the palmar surface shows that the central part of the shaft, called the palmar surface (13), is separated from the lateral and medial marginal ridges by a shallow groove on either side of it.

The lateral view (Figure 6.7c), and medial view (Figure 6.7d) of the shaft are very similar. The lateral ridge (12), medial ridge (18) and palmar surface (13) can be seen. The dorsal surface is straight in comparison to the concave palmar surface. Scheuer and Black (2000) describe the distal end of the shaft as being tapered.

### **6.8.2 Head (Figures 6.7a-e)**

Only a relatively small surface area of the head can be seen on a dorsal view (Figure 6.7a). The dorsal articular margin (1) is convexed towards the shaft. An intercondylar fossa (23) separates the lateral (8) and medial (2) condyles from each other (Figure 6.7e). These

condyles are slightly more prominent when compared to that of the thumb. The medial condyle is set at a higher or more distal level than the relatively smaller lateral condyle. The articular end of the medial condyle not only slopes more distally, it also projects out more medially than the lateral condyle. The rotation of the shaft in a lateral direction exposes the lateral fossa when the head is viewed from a dorsal aspect.

In a palmar view (Figure 6.7b) a relatively greater surface area of the head can be seen. The lateral (8) and medial (2) condyles are clearly seen with the medial condyle being elevated at a slightly higher level than the lateral condyle. The shallow intercondylar groove separating the two condyles is more marked from this view than from the dorsal aspect.

Lateral (Figure 6.7c) and medial (Figure 6.7d) views of the head are similar. The head shows tilting forward in a palmar direction in both views. The lateral condyle (8) surrounds the lateral fossa (9) and the medial condyle (2) surrounds the medial fossa (3).

When viewed from the articular end (Figure 6.7e), the head is rectangular in shape. The medial condyle (2) is relatively bigger than the lateral condyle (8). Both condyles tend to flare out to the sides. The palmar margin of the medial condyle is round in comparison to the pointed palmar margin of the lateral condyle. The intercondylar groove (23) is a shallow cavity located between these condyles.

### **6.8.3 Base (Figures 6.7a–d and f)**

A dorsal view (Figure 6.7a) shows a broad base in comparison with the rest of the bone. This view displays a round and convex medial margin in comparison to a straight lateral margin. The dorsal articular margin (7) is slightly concave in shape. The lateral end of the base is pulled in a proximal direction giving the appearance that the lateral margin (10) is tilted laterally and proximally.

In a palmar view (Figure 6.7b) the articulating margin (16) of the base is represented as an irregular line that is straight in comparison to the concave dorsal articular margin. The

lateral (15) and medial (14) tubercles surrounding a rough central region are located just distal to the palmar articular margin.

A straight articular margin as seen from a lateral view (Figure 6.7c), slopes in a distal direction from the dorsal to the palmar surface. The dorsal lateral (5) and palmar lateral (15) tubercles on either side of a lateral facet (20) can be easily identified.

The articular margin on the medial surface (Figure 6.7d) slopes in a distal direction from the palmar to dorsal surface. This slope is less than that observed on the lateral side. The dorsal medial (6) and palmar medial (14) tubercles are located just distal to the articular margin.

The base as observed from the articular end (Figure 6.7f) is oval in shape. The articular surface (24) is concave. The more prominent palmar medial tubercle (14) projects more medially when compared to the less prominent lateral tubercle (15). The lateral articular facet (20) is a prominent feature on the lateral margin. The dorsal articular margin is smooth in comparison to the irregular palmar articular margin.

#### **6.8.4 Siding**

In order to differentiate the right second proximal phalanx from the corresponding one on the left side, the bone is orientated with the palmar surface facing down and the dorsal surface facing up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2000).

For the purpose of the present study, a list of bony landmarks for the shaft, head and base of the second proximal phalanx will now be provided. This is to overcome any problems that may be encountered if only a fragment of the second proximal phalanx is found amongst skeletal remains.

##### Shaft

1. Medial margin (4) straight (Figures 6.7a and b)
2. Lateral margin (10) concave (Figures 6.7a and b)

3. Proximal end of shaft well developed and robust on the lateral side (Figure 6.7c)
4. Proximal end of shaft rotated laterally (Figures 6.7a and b)

Head

1. Surface area of medial condyle relatively larger than the lateral condyle (Figure 6.7e)
2. The palmar margin of the medial condyle is round (Figure 6.7e)
3. The palmar margin of the lateral condyle is pointed (Figure 6.7e)

Base

1. The medial articular margin is straight as seen from the articular end (Figure 6.7f)
2. The lateral articular margin is tapered as seen from the articular end (Figure 6.7f)

Figure 6.7: Morphology of the right (R) and left (L) second proximal phalanx



1=dorsal articular margin of head, 2=medial condyle of head, 3=medial fossa of head, 4=medial margin of shaft, 5=dorsal lateral tubercle of base, 6=dorsal medial tubercle of base, 7=dorsal articular margin of base, 8=lateral condyle of head, 9=lateral fossa of head, 10=lateral margin of shaft, 11=palmar articular margin of head, 12=palmar lateral ridge of shaft, 13=palmar surface of shaft, 14=palmar medial tubercle of base, 15=palmar lateral tubercle of base, 16=palmar articular margin of base, 17=distal palmar concavity of shaft, 18=palmar medial ridge of shaft, 19=slopes of condyles, 20=lateral articular facet of base, 21=lateral articular margin of base, 22=medial articular margin of base, 23=intercondylar fossa of head, 24=articular surface of base.

## **6.9 Morphology of the third proximal phalanx (Figures 6.8a-f)**

### **6.9.1 Shaft or body (Figures 6.8a-d)**

The literature generally describes the dorsal surface of the shaft as convex (Scheuer & Black 2000). In the present study, the shaft is smooth when observed from a dorsal view (Figure 6.8a), and relatively longer than the proximal phalanges of adjacent fingers. The medial margin is (4) is straight except in the proximal third where it becomes convex. The lateral margin (10) is also straight except for the midshaft region where it forms a slope and at the base it is convex.

The palmar surface (13) of the shaft (Figure 6.8b) is smooth and converges in the midshaft region creating the narrowest part of the bone compared to the broader proximal and distal ends. On either side of the shaft, the bone is rough. These are called the lateral (12) and medial (18) ridges. The concavity between these ridges and the palmar surface (13) is called the lateral (12) and medial (18) grooves. Scheuer and Black (2000) also observed the concave palmar surface in the third proximal phalanx of the juvenile hand.

The lateral surface of the shaft (Figure 6.8c) is interrupted by the rough lateral ridge (12). This ridge, which runs in an oblique manner from the dorsal to the palmar surface, is not present along the entire length of the lateral surface. In the proximal third, the lateral surface is smooth with no evidence of a ridge. The concave palmar and convex dorsal surfaces can be seen from this view. Scheuer and Black (2000) recorded that the shaft had a more flattened surface when viewed from side to side.

Features observed from a lateral view are also seen from a medial view (Figure 6.8d). One observation that is slightly different on the medial side when compared to the lateral view is that the rough medial ridge (18) tends to continue towards the palmar medial tubercle (14). In other words, this ridge is seen along the entire length of the medial surface.

### **6.9.2 Head (Figures 6.8a-e)**

Different features of the head are observed from different views. For example, in a dorsal view (Figure 6.8a) the dorsal articular margin (1) is much more prominent than that

observed for the first and second proximal phalanges. Thick ridges of bone extend from the articular margin to the sides where they surround the lateral and medial fossae respectively. Part of the lateral (8) and medial (2) condyles can be seen on the dorsal surface. The medial condyle is elevated at a slightly higher or more distal level than the lateral condyle.

In a palmar view (Figure 6.8b), the head is tilted laterally which may explain why the medial condyle is elevated at a higher level than the lateral condyle. The convex condyles are separated from each other by an intercondylar groove. A greater surface area of the head overlies the palmar than the dorsal aspect.

The head is not only tilted laterally but also forward on the shaft as seen from a lateral view (Figure 6.8c). The lateral condyle (8) forms a thin plate of bone surrounding the lateral fossa (9).

Features on the head as seen from a medial view (Figure 6.8d) is similar to that observed from a lateral view. The medial condyle (2) also forms a thin plate of bone surrounding the medial fossa (3).

When the head is viewed from the articulating end (Figure 6.8e), it is rectangular in shape. At first glance it may even give the appearance of being butterfly-shaped. The medial condyle (2) is set at a higher level than the lateral condyle (8) as seen from a dorsal and palmar view. The lateral condyle (8), however, is relatively bigger than the medial condyle (2) when viewed from the articular end. Both condyles are convex and tend to flare out to the sides, but the medial condyle does this to a greater extent than the lateral condyle. The intercondylar fossa (21) is a shallow concavity separating the two condyles. Due to the convexity of the condyles and the concavity of the intercondylar groove, the articular surface can be described as being concavo-convex.

### **6.9.3 Base (Figures 6.8a–d and f)**

A dorsal view (Figure 6.8a) shows a broad base in comparison with the rest of the bone. The dorsal lateral (5) and dorsal medial (6) tubercles are located just above the dorsal articular margin (1). Where the base joins the proximal end of the shaft a straight margin is

formed laterally, while on the medial side it is convex or rounded in shape. The dorsal articular margin varies from a horizontal line to one that is slightly curved. The lateral end of the base is pulled in a proximal direction, together with the rest of the lateral margin of the shaft.

From a palmar view (Figure 6.8b) the palmar articular margin (16) of the base also presents as a horizontal line but it is irregular in comparison with the smooth continuous line seen from the dorsal aspect. The palmar lateral (15) and palmar medial (14) tubercles are located on either side of a triangular region at the proximal end of the shaft.

A lateral view (Figure 6.8c) of the base shows the lateral articular margin (19) sloping distally from dorsal to palmar. The dorsal lateral (5) and palmar lateral (15) tubercles can be seen from this view.

In comparison, a medial view (Figure 6.8d) shows the medial articular margin (2) sloping distally from palmar to dorsal. The dorsal medial (6) and palmar medial (14) tubercles are seen from this view.

The articular end of the base (Figure 6.8f) indicates an oval-shaped surface which is concave. The more prominent dorsal medial (6) and less prominent dorsal lateral (5) tubercles can be identified. On the palmar surface, the palmar medial (14) and palmar lateral (15) tubercles are visible.

#### **6.9.4 Siding**

In order to differentiate the right third proximal phalanx from the corresponding one on the left side, the bone is orientated with the palmar surface facing down and the dorsal surface facing up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2000).

For the purpose of the present study, a list of bony landmarks for the shaft, head and base of the third proximal phalanx will now be provided. This is to overcome any problems that may be encountered if only a fragment of the third proximal phalanx is found amongst skeletal remains.

### Shaft

1. Medial ridge (18) straight and becomes convex at the base (Figure 6.8a)
2. Lateral ridge (12) straight in the distal third and concave in the proximal third (Figure 6.8a)
3. Lateral ridge of shaft (12) does not extend to the base (Figure 6.8c)
4. Medial ridge of shaft (18) extends to the base (Figure 6.8d)

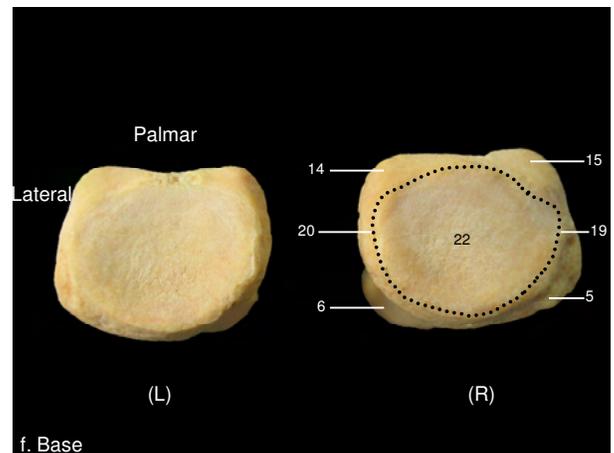
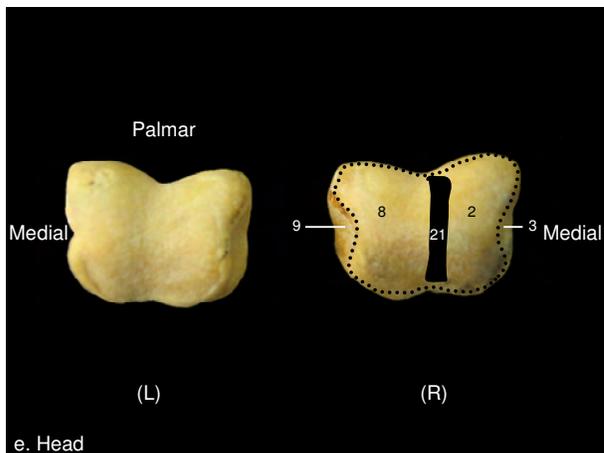
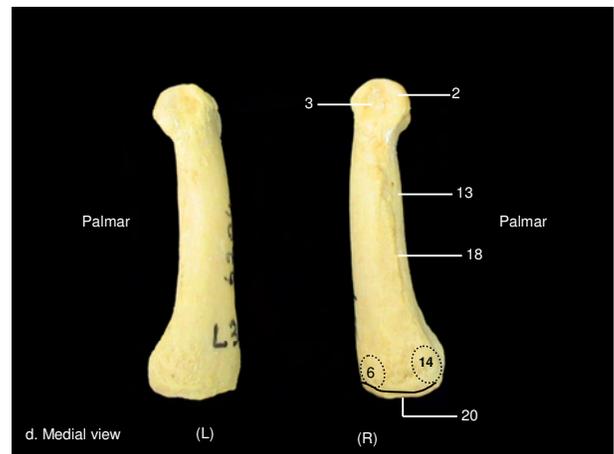
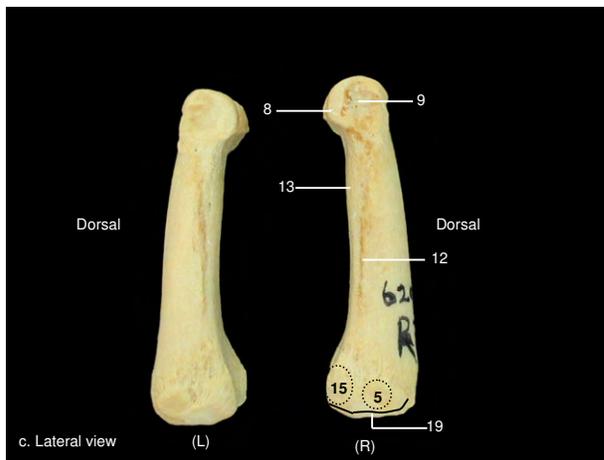
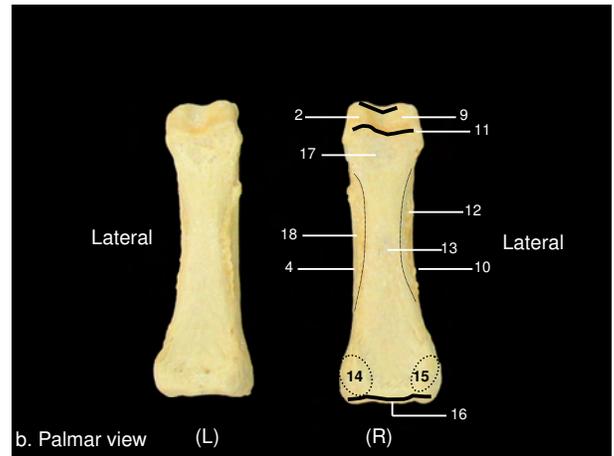
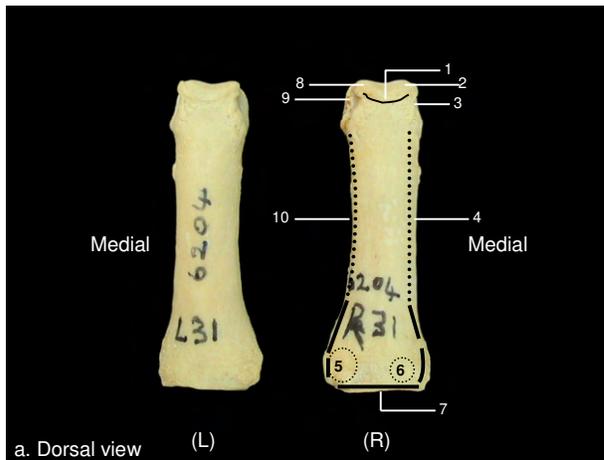
### Head

1. The medial condyle extends further distally than the lateral condyle (Figures 6.8a and b)
2. Lateral condyle (8) is relatively larger than medial condyle (2) (Figure 6.8e)

### Base

1. Dorsal articular margin is straight and smooth (7) (Figure 6.8a)
2. Palmar articular margin is straight and irregular (16) (Figure 6.8b)
3. The medial articular margin is slightly convex distally (20) (Figure 6.8d)
4. The lateral articular margin is markedly convex proximally (19) (Figure 6.8c)

Figure 6.8: Morphology of the right (R) and left (L) third proximal phalanx



1=dorsal articular margin of head, 2=medial condyle of head, 3=medial fossa of head, 4=medial ridge of shaft, 5=dorsal lateral tubercle of base, 6=dorsal medial tubercle of base, 7=dorsal articular margin of base, 8=lateral condyle of head, 9=lateral fossa of head, 10=lateral ridge of shaft, 11=palmar articular margin of head, 12=palmar lateral ridge of shaft, 13=palmar surface of shaft, 14=palmar medial tubercle of base, 15=palmar lateral tubercle of base, 16=palmar articular margin of base, 17=distal palmar concavity of shaft, 18=palmar medial ridge of shaft, 19=lateral articular margin of base, 20=medial articular margin of base, 21=intercondylar fossa of head, 22=articular surface of base.

## 6.10 Morphology of the fourth proximal phalanx (Figures 6.9a-f)

### 6.10.1 Shaft or body (Figures 6.9a-d)

This bone is relatively shorter and more slender when compared to the proximal phalanges of the middle finger but relatively longer than the corresponding bone of the thumb, index and little finger. Observations from a dorsal view (Figure 6.9a), indicate a lateral (10) and medial (4) margins on either side of the shaft. Both margins are straight except for the proximal third where they slope to the respective sides. The slope of the lateral margins, indicated by a solid line on the diagram, is longer and more angulated than the slope of the medial ridge. The dorsal surface of the shaft is smooth along its entire length. At the distal end where the shaft joins the head, the lateral and medial margins are also sloped to the respective sides. These slopes are not as marked as the proximal end. The shaft is rotated at its proximal end to the medial rather than the lateral side. This rotation is a feature similar to that observed in the thumb, index and middle fingers.

Morphological features observed on a palmar view (Figure 6.9b), is similar to that seen in the index and middle finger. The palmar surface (14) is broader proximally than at the distal end and narrowest in the midshaft region. The lateral (10) and medial (4) margins project more forward and ending in rough edges, a feature not observed from a dorsal view. Between the palmar surface and lateral (13) and medial (18) ridges, are the lateral and medial grooves. The central region of the shaft is smooth along its entire length. At the distal end of the shaft, just below the palmar articular margin, is a shallow depression or concavity (12). Numerous foramina are located at the proximal end. The rotation of the distal half of the shaft results in the palmar lateral tubercle (16), which is relatively bigger and set at a higher level than the palmar medial tubercle (15), projecting more forward than the palmar medial tubercle.

From a lateral perspective (Figure 6.9c), the shaft displays a concave palmar and convex dorsal surface. The convexity of the dorsal surface is more marked in the distal than in the proximal region mainly due to the forward tilt of the head on the shaft. In fact, the convexity

at the proximal end becomes a straight line. The lateral ridge (13) is more prominent in the midshaft than at the proximal and distal ends.

Features observed from a lateral view are also seen from a medial view (Figure 6.9d). In other words, the medial ridge (18) separating the dorsal and palmar surfaces from each other can be clearly identified. This ridge is more marked in the midshaft region than at the proximal and distal ends, similar to that observed from a lateral view. The rotation of the proximal end of the shaft medially, exposes more of the palmar surface from a medial view. In other words, the lateral margin is also visible from this view. The palmar surface is concave and the dorsal surface is convex.

### **6.10.2 Head (Figures 6.9a-e)**

In a dorsal view (Figure 6.9a) the head is located at the distal end of the shaft. A well-defined dorsal articular margin (1) separates the distal end of the shaft from the condyles. This articular margin is convex proximally. The lateral (8) and medial (2) condyles are separated by a shallow intercondylar fossa. The lateral condyle is set at a higher or more distal level than the medial condyle. A lateral (9) and medial (3) fossa can be seen on the lateral and medial sides respectively.

A palmar view of the head (Figure 6.9b) indicates a straight palmar articular margin (11). No sloping of this margin occurs as is the case with the middle finger. The lateral condyle (8) is raised more distally compared to the medial condyle (2). When compared to the dorsal view, a greater surface area of the head can be seen from a palmar view. This is due to the head projecting forward on the shaft. The width of the head from this perspective is relatively greater than the height.

The tilting of the head towards the palmar aspect is much more evident from a lateral view (Figure 6.9c) than from a medial view. The lateral fossa (9) is seen as a shallow depression surrounded by a thin plate of bone, the lateral condyle (8).

A medial view (Figure 6.9d) of the head also shows a shallow medial fossa (3) surrounded by the medial condyle (2).

When viewed from the articular end (Figure 6.9e), the head is butterfly-shaped with the dorsal margin narrow and palmar margin broad. The shape may also be defined as rectangular. Both condyles project outwards to the lateral and medial sides respectively. The lateral condyle (8) has a relatively larger surface area than the medial condyle (2). The intercondylar fossa (21) can be identified between the two condyles. The lateral (9) and medial (3) fossae are visible on the sides.

### **6.10.3 Base (Figures 6.9a-d and f)**

The base from a dorsal view (Figure 6.9a) is broad with convex lateral and medial margins. The dorsal lateral (5) and dorsal medial (6) tubercles are clearly seen. The dorsal articular margin (7) is straight.

Two tubercles can be identified on the palmar surface of the base (Figure 6.9b). These are the palmar lateral (16) and palmar medial (15) tubercles. The palmar lateral tubercle is relatively larger and projects more anteriorly than the palmar medial tubercle. The palmar articulating margin (17) slopes in a proximal direction from the medial to the lateral surface. Nutrient foramina can be seen between the two palmar tubercles.

The lateral surface of the base (Figure 6.9c) shows a relatively smaller dorsal lateral (5) and a relatively larger palmar lateral (16) tubercle. The lateral articular margin (19) tends to slope proximally from the dorsal to the palmar surface.

Two tubercles can also be identified on the medial surface (Figure 6.9d). These are the relatively smaller dorsal medial (6) and relatively larger palmar medial (15) tubercles. The medial articular margin (20) has a slight convexity in a proximal direction.

The articular surface (22) of the base (Figure 6.9f), displays an oval shape. The dorsal margin is convex compared to the bi-convex palmar margin. This bi-convexity is due to the prominence of the palmar lateral (16) and palmar medial (15) tubercles. From this view, the palmar lateral tubercle is seen to be relatively larger than the palmar medial tubercle.

#### 6.10.4 Siding

In order to differentiate the right fourth proximal phalanx from the corresponding one on the left side, the bone is orientated with the palmar surface facing down and the dorsal surface facing up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2000).

For the purpose of the present study, a list of bony landmarks on the shaft, head and base of the fourth proximal phalanx will now be provided. This is to overcome any problems that may be encountered if only a fragment of the fourth proximal phalanx is found amongst skeletal remains.

##### Shaft

1. Medial margin (4) extends further proximally than the lateral margin (Figure 6.9a)
2. Lateral margin (10) more prominent and sharp in the midshaft region when compared to the medial margin (Figure 6.9c)

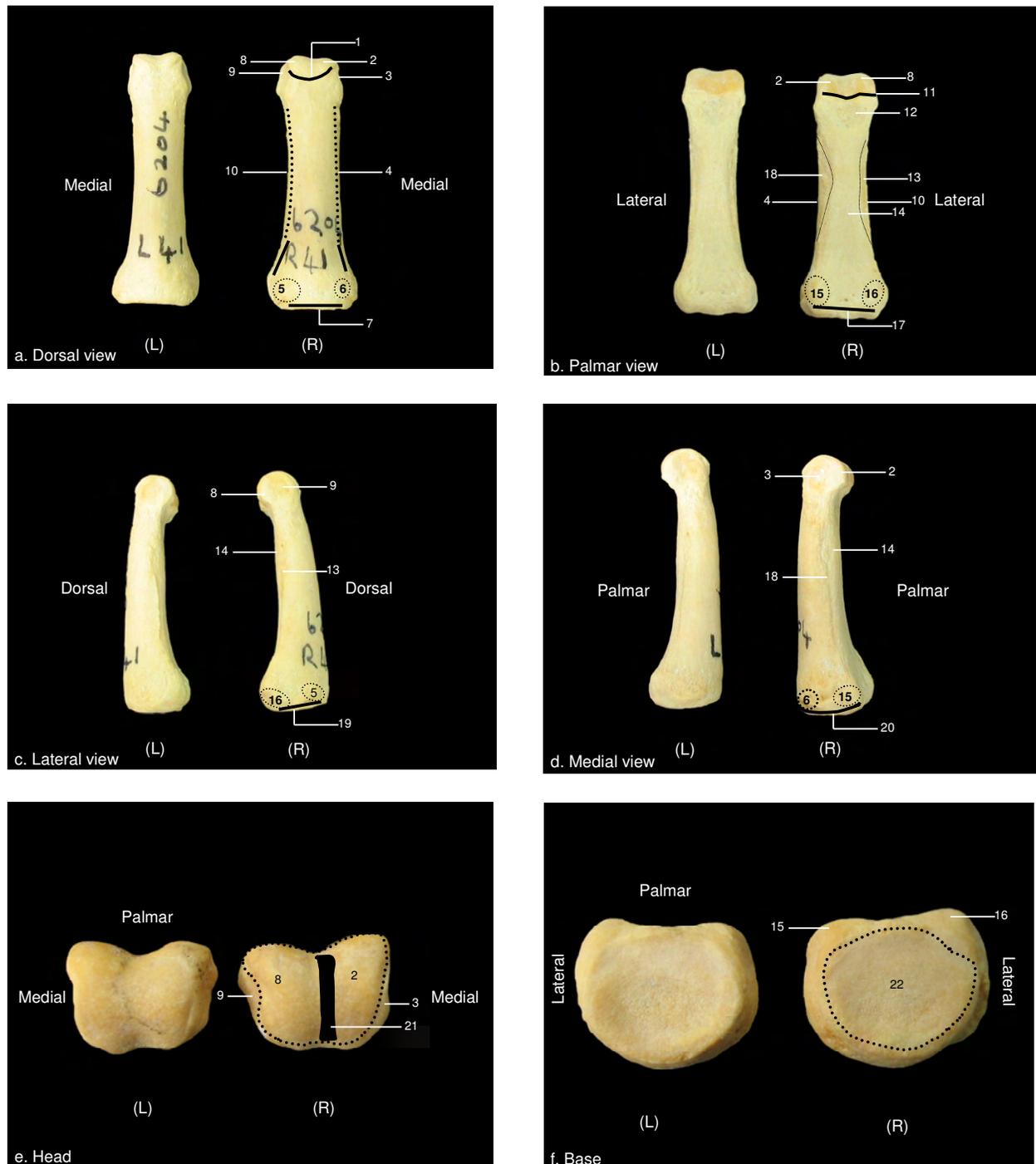
##### Head

1. Lateral condyle (8) relatively larger than the medial condyle (2) (Figure 6.9e)
2. Medial border relatively longer than lateral border (Figure 6.9e)
3. Lateral condyle (2) raised at a higher level than the medial condyle (Figures 6.9a and b)

##### Base

1. Palmar articular margin (17) slopes in a proximal direction from the medial to the lateral surface (Figure 6.9b)
2. Palmar lateral tubercle (16) projects more anteriorly and is relatively larger than the palmar medial tubercle (15) (Figures 6.9b and f)

Figure 6.9: Morphology of the right (R) and left (L) fourth proximal phalanx



1=dorsal articular margin of head, 2=medial condyle of head, 3=medial fossa of head, 4=medial ridge of shaft, 5=dorsal lateral tubercle of base, 6=dorsal medial tubercle of base, 7=dorsal articular margin of base, 8=lateral condyle of head, 9=lateral fossa of head, 10=lateral ridge of shaft, 11=palmar articular margin of head, 12=distal palmar concavity of shaft, 13=palmar lateral ridge of shaft, 14=palmar surface of shaft, 15=palmar medial tubercle of base, 16=palmar lateral tubercle of base, 17=palmar articular margin of base, 18=palmar medial ridge of shaft, 19=lateral articular margin of base, 20=medial articular margin of base, 21=intercondylar fossa of head, 22= articular surface of base.

## 6.11 Morphology of the fifth proximal phalanx (Figures 6.10a-f)

### 6.11.1 Shaft or body (Figures 6.10a-d)

The shaft is described in the literature as being convex on its dorsal aspect and concave along its longitudinal axis on the palmar surface. When viewed from side to side, the shaft is flattened (Scheuer & Black 2000). In the present study, the proximal phalanx of the fifth digit was seen to be shorter and more robust in comparison to the proximal phalanges of the other digits.

From a dorsal view (Figure 6.10a) the lateral margin (8) is straight for most of its course except at the proximal end where it is sloped as it approaches the base. The concave medial margin (4), projects more medially at the proximal end causing the shaft to be tilted slightly medially. The width of the shaft proximally is thus greater than at the distal end. The width at the midshaft and distal regions is approximately the same unlike that observed in the proximal phalanges of adjacent digits, where the midshaft was the narrowest region.

Observations of the palmar surface (Figure 6.10b) confirm the relatively longer straight lateral ridge (8) compared to the relatively shorter concaved medial ridge (4). The distal palmar concavity (15) is a shallow depression proximal to the head. While this concavity was observed in adjacent proximal phalanges, its size in the fifth proximal phalanx is relatively larger. The lateral (10) and medial (16) ridges are rough on the palmar surface when compared to the smooth appearance on the dorsal surface. The grooves located between these ridges and the palmar surface (11), are referred to as the lateral and medial grooves of the shaft. Nutrient foramina can be identified in the proximal third of the shaft.

The lateral surface (Figure 6.10c) of the shaft shows the rough lateral ridge (10) prominent in the midshaft region. The proximal third of this surface is rough compared to the smooth distal two thirds. The dorsal surface is straight while the palmar surface is concave. The broadest part of the shaft is at the proximal end after which the shaft narrows.

Observations of the medial surface (Figure 6.10d) are exactly the same as that identified on the lateral surface, except that the terminologies are different.

### 6.11.2 Head (Figures 6.10a-e)

The presence of the lateral (6) and medial (2) condyle in this bone is a feature which is also observed on adjacent proximal phalanges. Closer observation of the lateral condyle from a dorsal aspect (Figure 6.10a), indicates that it is set at a higher or more distal level than the medial condyle. The dorsal articular margin (1) converges to the center and has a convex shape in a proximal direction. The lateral and medial condyles form thick ridges on each side of the articular margin, and then continue onto the palmar aspect. Thus, when the head is observed from the lateral or medial side, the condyles appear as complete circles surrounding the lateral and medial fossae.

In a palmar view (Figure 6.10b) the tilting of the head is much more prominent revealing the greater height of the lateral condyle (6) in comparison to the medial condyle (2). The slope formed on the uppermost or distal part of the head is indicated by a solid line in this figure. The palmar articular margin, indicated by the more proximal solid line, has a scalloped edge which slopes in the same direction as the head, namely, medially.

Turning the bone laterally (Figure 6.10c), the lateral condyle (6) can be seen as a complete circle encasing the lateral fossa (7). The head is also tilted forward.

A medial view (Figure 6.10d) the head is similar in comparison to the lateral view. The medial condyle (2) is also a complete circle surrounding the medial fossa (3).

When the head is observed from its articular end (Figure 6.10e), the shape of the articular surface is almost triangular. The lateral and medial articular margins converge but it leaves a relatively short margin on the dorsal surface. The palmar margin is relatively longer than the dorsal margin. The lateral condyle (6) occupies a slightly greater surface area than the medial condyle (2). The amount of flaring of the condyles is slight and not as marked as observed in adjacent proximal phalanges.

### 6.11.3 Base (Figures 6.10a-d and f)

The dorsal surface of the base (Figure 6.10a) is rough with numerous nutrient foramina. The articular margin (5) is slightly concave in a proximal direction. The medial margin of the base has a greater curvature or convexity than the lateral margin as indicated by the curved solid line on the figure. The palmar articular margin (14) can be seen from a dorsal view because it extends more proximally than the dorsal articular margin (5). The base is greater in width than the rest of the bone.

When viewed from a palmar perspective (Figure 6.10b), two tubercles are visible, namely, a relatively larger palmar lateral (13) and a relatively smaller palmar medial (12) tubercle. The palmar articular margin (14) has a scalloped appearance and the center of this margin extends further proximally making it visible from a dorsal perspective. The base is also much broader than the rest of the bone.

The lateral surface of the base (Figure 6.10c) is also rough with numerous tiny foramina. The palmar lateral (13) tubercle is located anteriorly. The articular margin (17) is relatively straight and forms a slope dorsally. The base is much broader than the rest of the bone. No articular facet is present on the lateral aspect of the base.

The medial surface of the base (Figure 6.10d) is also much broader than the rest of the shaft. The medial articular margin (18) is slightly convex and continues to the dorsal surface. A palmar tubercle (12) can be identified at the anterior end of the base.

When viewed from the articular end (Figure 6.10f), the base is oval in shape with a smooth articular surface (20). The palmar medial tubercle (12) is relatively bigger than the palmar lateral tubercle (13).

### 6.11.4 Siding

In order to differentiate the right fifth proximal phalanx from the corresponding one on the left side, the bone is orientated with the palmar surface facing down and the dorsal surface

facing up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2000).

For the purpose of the present study, a list of bony landmarks on the shaft, head and base of the fifth proximal phalanx will now be provided. This is to overcome any problems that may be encountered if only a fragment of the fifth proximal phalanx is found amongst skeletal remains.

#### Shaft

1. Lateral margin (8) relatively longer than the medial margin (Figures 6.10a and b)
2. Medial margin (4) relatively short and concave (Figures 6.10a and b)

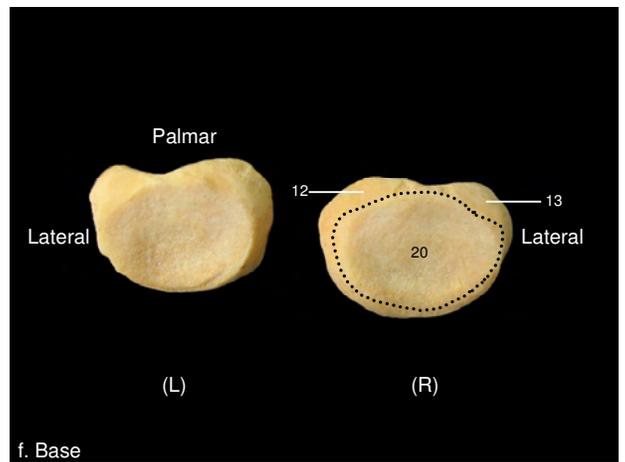
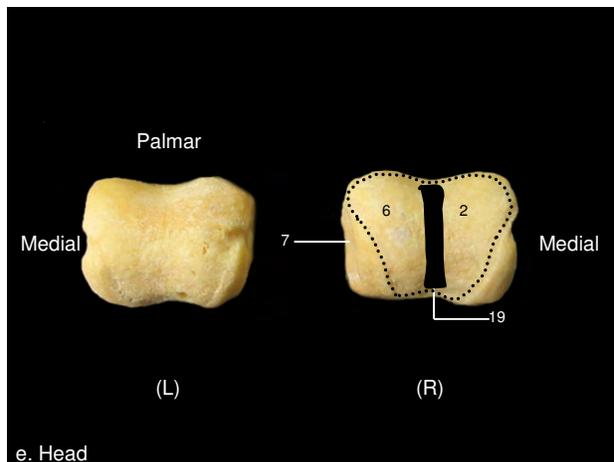
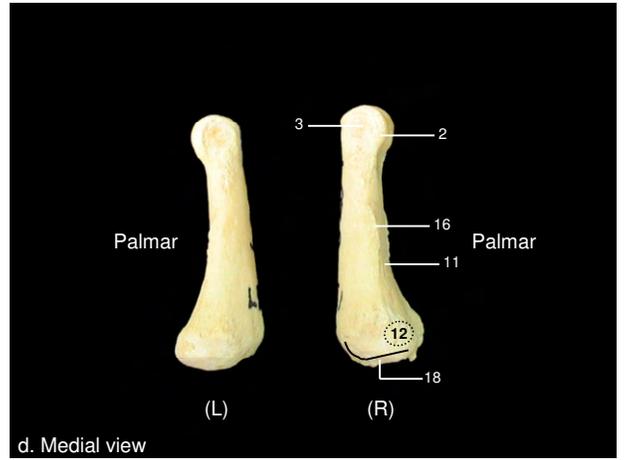
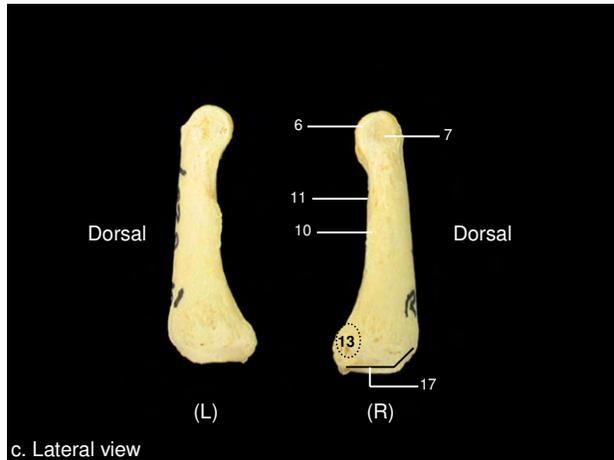
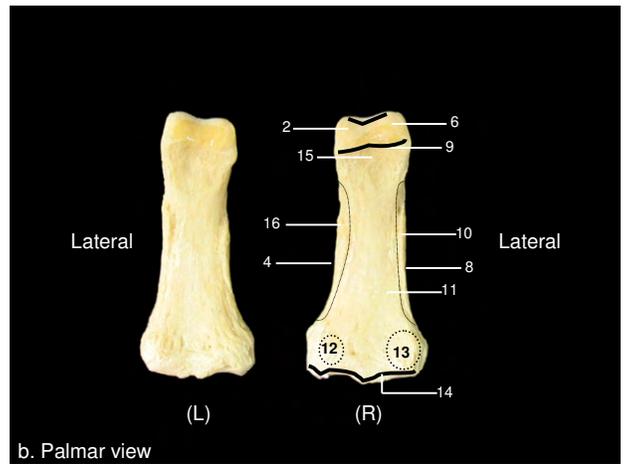
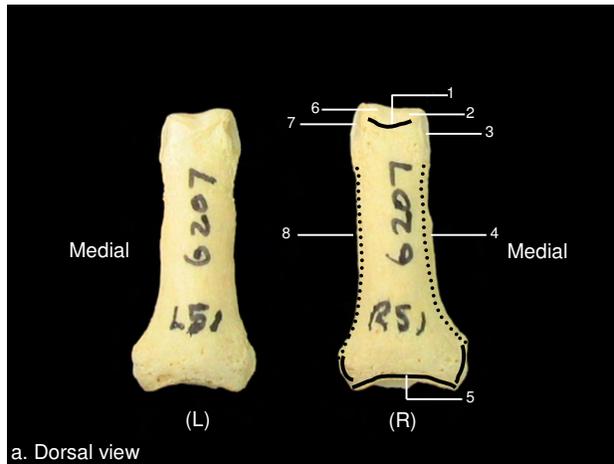
#### Head

1. Lateral condyle (6) raised at a higher level than the medial condyle (Figures 6.10a and b)
2. Medial condyle (2) flares out more to the side than the lateral condyle (Figure 6.10b)

#### Base

1. Medial margin of base has greater height than the lateral margin (Figure 6.10a)
2. Medial margin of base has greater height than the lateral margin (Figures 6.10c and d)
3. Palmar medial tubercle relatively greater in size than the palmar lateral tubercle (Figure 6.10f)

Figure 6.10: Morphology of the right (R) and left (L) fifth proximal phalanx



1=dorsal articular margin of head, 2=medial condyle of head, 3=medial fossa of head, 4=medial ridge of shaft, 5=dorsal articular margin of base, 6=lateral condyle of head, 7=lateral fossa of head, 8=lateral ridge of shaft, 9=palmar articular margin of head, 10=palmar lateral groove of shaft, 11=palmar surface of shaft, 12=palmar medial tubercle of base, 13=palmar lateral tubercle of base, 14=palmar articular margin of base, 15=distal palmar concavity of shaft, 16=palmar medial groove of shaft, 17=lateral articular margin of base, 18=medial articular margin of base, 19=intercondylar groove of head, 20=articular facet of base.

## **6.12 Morphology of the second middle phalanx (Figures 6.11a-f)**

### **6.12.1 Shaft or body (Figures 6.11a-d)**

A dorsal view (Figure 6.11a) depicts a short and more robust shaft in comparison to the middle phalanges of the adjacent digits. The shaft shows greater width proximally than distally. The lateral and medial margins are concave with the curvature on the lateral aspect being slightly greater than on the medial side. The lateral margin is also relatively longer than the medial margin. The bending of this bone seen in the midshaft region causes the proximal half of the lateral margin not only to extend more laterally but also to tilt in a palmar direction. The shaft is smooth along its entire length. A few randomly located foramina may be seen at the distal end of the shaft.

From a palmar aspect (Figure 6.11b) the middle phalanx of the second digit is seen to be the shortest and most robust, when compared to the middle phalanges of digits three to five. Unlike the entire smooth dorsal surface, the palmar surface has a central area that is smooth (14). On either side of this central area, the lateral (15) and medial (17) palmar ridges located at the midshaft level can be identified. These ridges are distinct from the smooth central area as they appear rough. Few small foramina may be seen scattered randomly at the proximal and distal ends. The proximal half of the shaft is rotated.

The buckling or anterior tilting of the midshaft is more obvious from a lateral view (Figure 6.11c) than from the dorsal and palmar aspects. The dorsal surface is convex and the palmar surface is concave.

Not only is the buckling or anterior tilting of the midshaft clearly seen from a medial view (Figure 6.11d), but medial rotation of the shaft along its longitudinal axis, is more prominent at this angle than from a lateral view.

### **6.12.2 Head (Figures 6.11a-e)**

In this example of the head, the articular surface of the right (R) middle phalanx is worn down compared to the corresponding bone on the left (L) side. Nonetheless, two condyles can

be seen from a dorsal view (Figure 6.11a). These are the lateral (8) and medial (1) condyles, very similar to that identified on the head of the proximal phalanges except that in this instance, they are relatively smaller. The head projects mainly forward, resulting in only a relatively small area being visible on the dorsal aspect. Scheuer and Black (2000) referred to these condyles as the lateral and medial elevations. The dorsal articular margin (3) can be identified as a horizontal line between the two condyles.

A greater surface area of the head can be seen from a palmar view (Figure 6.11b). The palmar articular margin (13) is visible between the two condyles.

When viewed from the lateral side (Figure 6.11c), the lateral condyle (8) forms a complete circle which surrounds the lateral fossa (9). The head is rotated laterally with a slight forward projection. There is great variation in the size and shape of this condyle, not only in different individuals but also between hands of the same individual.

When the bone is turned in such a way that the medial surface (Figure 6.11d) can be seen, the rotation of the head and distal end of the shaft in a lateral direction is more marked than that observed from the lateral view. The medial condyle (1) surrounding the medial fossa (2) can be easily identified. The thick rim of bone identified on the lateral and medial aspects may occur as a result of bone remodeling in these regions.

A superior view (Figure 6.11e) shows a great deal of variability in the shape of the head, not only in different individuals but also in middle phalanges of the right and left hand of the same individual. The shape may vary from rectangular to square. The width on the palmar surface is greater than on the dorsal aspect. Scheuer and Black (2000) refer to the head as the distal metaphyseal surface that is convex from dorsal to ventral. In the present study, this convex surface had a shallow concavity separating the two condyles. Scheuer and Black (2000) go on to describe the slope on the dorsal aspect as being steeper than on the ventral surface. This was not observed on the middle phalanx of the index finger. A feature observed on the articular surface of the head and indicated by a circle (Figure 6.11e), represents a shallow fossa which may be due to erosion or arthritic changes at this end of the bone. In this example, the eroded region was identified on the medial side of both the right and left bones.

### 6.12.3 Base (Figures 6.11a-d and f)

The articular margin of the base, when observed from a dorsal view (Figure 6.11a), slopes in a proximal direction. These are called the lateral (12) and medial (6) slopes respectively. Where these slopes meet, it is referred to as the apex (7). Scheuer and Black (2003) referred to this central point as a tubercle for attachment of the extensor digitorum muscle. Distal to these slopes at the margins are the lateral (11) and medial (5) tubercles. A striking difference with the articular margin (16) on the palmar surface of the base (Figure 6.11b), is that it is curved rather than sloped.

The shape of the articular margin on the lateral surface (Figure 6.11c) may vary from being straight to concave. If this articular margin is followed through to the dorsal surface, it projects down or proximally together with the apex (7). The oval-shaped lateral tubercle (11) can be located distal to this articular margin.

Similar to a lateral view of the base, the medial view (Figure 6.11d) also shows the medial articular margin (19) as a straight line. It is only at its dorsal end where it runs obliquely in a proximal direction for a short while where it also contributes to the formation of the dorsal apex of the base. The oval-shaped and relatively large medial tubercle (5) extends from dorsal to palmar ends across the medial margin.

The articular surface of the base (Figure 6.11f), takes on an oval shape. The palmar, lateral and medial articular margins tend to be straight. The dorsal articular margin, on the other hand, is convex and longer than the palmar articular margin. The rotation of the base medially is clearly seen from this view. Two shallow depressions can be identified, namely, the relatively smaller lateral (22) and relatively larger medial (21) articular facets, separated by a broad interarticular ridge (23) that is convex.

### 6.12.4 Siding

In order to differentiate the right second middle phalanx from the corresponding one on the left side, the bone is orientated with the palmar surface facing down and the dorsal surface

facing up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2000).

For the purpose of the present study, a list of bony landmarks on the shaft, head and base of the second middle phalanx will now be provided. This is to overcome any problems that may be encountered if only a fragment of the second middle phalanx is found amongst skeletal remains.

#### Shaft

1. Lateral margin (10) projects more in a palmar direction than the medial margin (4) (Figures 6.11a and b)

#### Head

1. Head rotated laterally (Figures 6.11a and c)

#### Base

1. Apex on dorsal surface (7) directed laterally (Figure 6.11a)
2. Dorsal lateral articular slope (12) shorter than dorsal medial articular slope (6) (Figure 6.11a)

Figure 6.11: Morphology of the right (R) and left (L) second middle phalanx



1=medial condyle of head, 2=medial fossa of head, 3=medial articular margin of head, 4=medial margin of shaft, 5=medial tubercle of base, 6=dorsal medial slope of base, 7=dorsal apex of base, 8=lateral condyle of head, 9=lateral fossa of head, 10=lateral margin of shaft, 11=lateral tubercle of base, 12=dorsal lateral slope of base, 13=palmar articular margin of head, 14=palmar surface of shaft, 15=palmar lateral ridge of shaft, 16=palmar articular margin of base, 17=palmar medial ridge of shaft, 18=lateral articular margin of base, 19=medial articular margin of base, 20=artifact on head, 21=medial articular facet of base, 22=lateral articular facet of base, 23=interarticular ridge of base.

## **6.13 Morphology of the third middle phalanx (Figures 6.12a-f)**

### **6.13.1 Shaft or body (Figures 6.12a-d)**

The shaft of this bone is relatively longer and wider than that of the index finger when viewed from the dorsal aspect (Figure 6.12a). The lateral margin (10) is concave whereas the medial margin (4) is straight. The difference in shape of these margins causes the shaft to be tilted in a slightly lateral direction. The surface is relatively smooth with sparsely scattered foramina at the proximal and distal ends.

The bending or anterior tilting in the midshaft region from a palmar aspect (Figure 6.12b), where the lateral margin forms an angle, is more prominent when compared to that observed in the index finger. The lateral palmar ridge (15) is also more prominent and elongated when compared to the less prominent and shorter medial palmar ridge (17). A few sparsely scattered foramina may be seen at the proximal and distal ends of the shaft.

Turning the bone so that the lateral surface is conspicuous (Figure 6.12c), displays a convex dorsal and concave palmar surface. A thin line demarcating the lateral margin (10) can be identified at the midshaft. The rest of the proximal half is taken up by the lateral ridge (15) which is seen as a forward projection of part of the bone. At the distal end of the shaft just below the head, the bone appears rough. The shaft is broader proximally than distally.

A view of the same bone from a medial direction (Figure 6.12d), indicates that the medial margin (4) is rough in the distal third where it is visible. While the medial ridge (17) also projects forward, it is not as prominent as the one observed from the lateral surface. The rest of this surface is similar to the lateral surface.

### **6.13.2 Head (Figures 6.12a-e)**

The lateral (8) and medial (2) condyles appear as thick bony ridges on the dorsal surface of the head (Figure 6.12a). The dorsal articular margin (1) is convex in a proximal direction. The width of the head is narrower than on the palmar surface making it easy to identify the lateral (9) and medial (3) fossae.

These condyles become more prominent on the palmar surface (Figure 6.12b). The articular margin (13) on this surface of the bone is concave in a proximal direction. Numerous foramina can be located just proximal to this margin. At first glance, the articular surface appears smooth.

From a lateral view, rotation of the distal end of the shaft laterally, causes both condyles to be visible (Figure 6.12c). While only the medial condyle (2) can be identified, both the lateral condyle (8) and the lateral fossa (9) which it encircles can be seen from this view.

A medial view (Figure 6.12d) only reveals the medial condyle (2) which forms a complete circle around the medial fossa (3).

The head is rectangular-shaped as observed from a superior view (Figure 6.12e). The palmar and dorsal margins are relatively greater in length than the lateral and medial margins which are relatively shorter in length. The articular surface is smooth.

### **6.13.3 Base (Figures 6.12a-f)**

A dorsal view of the base (Figure 6.12a) has two slopes similar to that observed in the middle phalanx of the index finger. The point where the short lateral and long medial slopes join is called the apex (7). Distal to each slope, the lateral (11) and medial (5) tubercles are located.

Features on the palmar surface (Figure 6.12b) include an articular margin (16) that slopes in a proximal direction from the lateral to the medial surface. Distal to this articular margin, the base is rough and presents with fine ridges running parallel to each other.

The articular margin (18) on the lateral surface (Figure 6.12c) is sloped in a proximal direction from the palmar to the dorsal surface. An oval-shaped lateral tubercle (11) can be seen proximal to this articular margin.

In contrast, the medial (19) articular margin (Figure 6.12d) runs a straight course from the palmar to the dorsal surface. An oval-shaped medial tubercle (5) is associated with this margin.

The articular surface of the base is oval in shape (Figure 6.12f), with the medial articular facet (22) being relatively larger than the lateral articular facet (20). These facets are separated from each other by an interarticular ridge (21). The medial tubercle (5) is much more prominent than the lateral tubercle (11).

#### **6.13.4 Siding**

In order to differentiate the right third middle phalanx from the corresponding one on the left side, the bone is orientated with the palmar surface facing down and the dorsal surface facing up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2000).

For the purpose of the present study, a list of bony landmarks on the shaft, head and base of the third middle phalanx will now be provided. This is to overcome any problems that may be encountered if only a fragment of the third middle phalanx is found amongst skeletal remains.

##### Shaft

1. Lateral margin is angulated (10) (Figures 6.12a and b)
2. Medial margin is concave and straight (4) (Figures 6.12a and b)
3. Shaft tilted laterally (Figures 6.12a and b)
4. Lateral palmar ridge more prominent and elongated (15) (Figure 6.12b)
5. Medial palmar ridge less prominent and short (17) (Figure 6.12b)

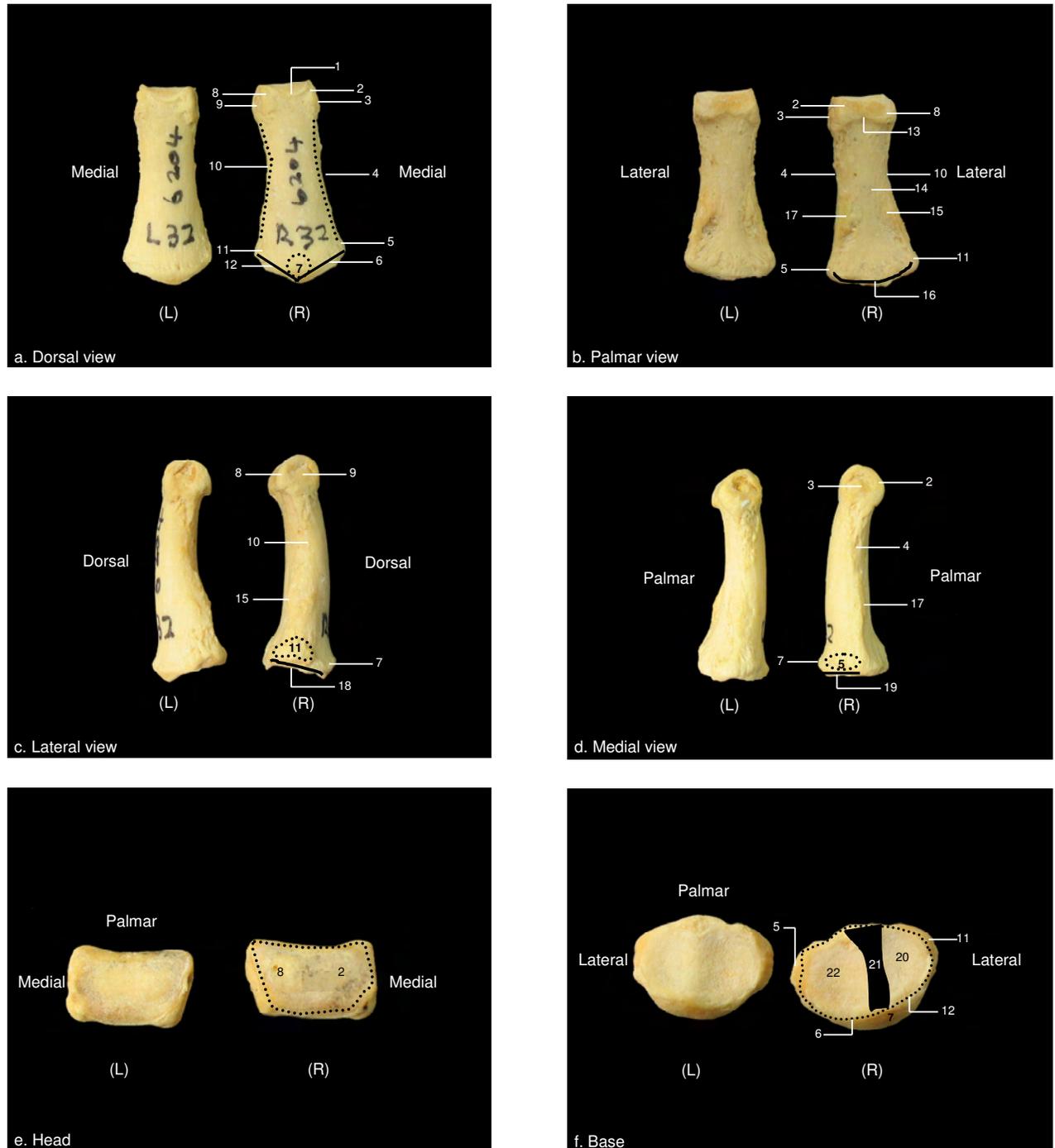
##### Head

1. Head rotated laterally (Figures 6.12a and c)
2. Lateral and medial margins of head slopes medially (Figure 6.12e)

##### Base

1. Prominent medial tubercle (5) from articular surface (Figure 6.12f)
2. Less prominent lateral tubercle (11) (Figure 6.12f)

Figure 6.12: Morphology of the right (R) and left (L) third middle phalanx



1=dorsal articular margin of head, 2=medial condyle of head, 3=medial fossa of head, 4=medial margin of shaft, 5=medial tubercle of base, 6=dorsal medial slope of base, 7=dorsal apex of base, 8=lateral condyle of head, 9=lateral fossa of head, 10=lateral margin of shaft, 11=lateral tubercle of base, 12=dorsal lateral slope of base, 13=palmar articular margin of head, 14=palmar surface of shaft, 15=palmar lateral ridge of shaft, 16=palmar articular margin of base, 17=palmar medial ridge of shaft, 18=lateral articular margin of base, 19=medial articular margin of base, 20=lateral articular facet of base, 21=interarticular ridge of base, 22=medial articular facet of base.

## **6.14 Morphology of the fourth middle phalanx (Figures 6.13a-f)**

### **6.14.1 Shaft or body (Figures 6.13a-d)**

A dorsal view of this bone (Figure 6.13a), shows angulation of the lateral margin in the midshaft area (Figure 6.13a). A feature similar to that observed in the index and middle fingers but not as marked. It is this angulation that gives the lateral margin (10) a slight concavity. On closer observation, this angulation is actually a slope that is formed by the proximal two-thirds, after which it forms a straight line at the distal third. The concavity of the medial margin (4) is less and in some cases this margin is straight. The broadest part of this bone is the proximal half. The midshaft and distal ends are relatively similar in diameter. The shaft is smooth along its entire length with sparsely scattered foramina at the proximal and distal ends. The distal end of the shaft tends to rotate in a lateral direction.

The palmar view (Figure 6.13b) is very similar to the dorsal view. Some of the differences include the lateral (15) and medial (17) ridges which occur on either side of the smooth palmar surface (14). Nutrient foramina are more prevalent in the distal third.

A lateral view (Figure 6.13c) shows a convex dorsal and a concave palmar surface. Due to the angulation of the shaft, the dorsal surface is tilted slightly forward at its distal end while proximally the shaft is straight. The rough lateral ridge (15) stands out as a sharp bony projection in the proximal half. The width of the shaft is greater at the proximal than at the distal end.

The medial surface (Figure 6.13d) is similar to the lateral surface. In other words, the distal end of the shaft is angulated forward while the proximal end is straight. The rough medial ridge (17) appears as a sharp bony projection in the proximal half of the shaft.

### **6.14.2 Head (Figures 6.13a-e)**

The surface area of the head, when viewed dorsally (Figure 6.13a), is relatively small. The difference in height of the lateral (8) and medial (2) condyles is responsible for the slope seen at the articular end. In other words, the medial condyle extends more distally than the

lateral condyle. The opposite was true for the middle finger. The dorsal articular margin (1), which is convexed proximally, is clearly demarcated from the lateral (8) and medial (2) condyles, which continue onto the lateral and medial surfaces.

A greater surface area of the head can be seen from a palmar aspect (Figure 6.13b). The straight articular margin (13) is relatively longer than the corresponding one on the dorsal surface. The condyles are convexed distally with a shallow depression separating them.

Due to the distal end of the shaft rotating more laterally than the rest of the bone, both the lateral and medial aspects of the head can be seen from a lateral view (Figure 6.13c). The head extends forward on the shaft. The lateral condyle (8) can be identified as a circular rim of bone surrounding the lateral fossa (9).

Due to the distal half of the shaft rotating more laterally than medially, only the medial (2) and not the lateral (8) condyle can be identified (Figure 6.13d). From this view, the head extends forward on the shaft and the medial condyle (2) is seen as a circular rim of bone surrounding the medial fossa (3).

The head is rectangular in shape as seen from the articular end (Figure 6.13e) with the dorsal and palmar margins being relatively longer than the shorter medial and lateral margins. The lateral margin runs obliquely from the dorsal to the palmar aspect, while the medial margin tends to be straight. Similar to the index and middle fingers, the lateral condyle in the ring finger forms a sharp edge and projects more laterally on the palmar surface when compared to the more rounded medial condyle.

#### **6.14.3 Base (Figures 6.13a-d and f)**

From a dorsal view (Figure 6.13a) the base presents with two slopes of almost equal length, namely, a lateral (12) and medial (6) slope similar to that seen in the index finger. At the point where the lateral and medial slopes meet a round apex is formed. This apex maintains a neutral position unlike that of the index and middle fingers where the apices are medially orientated. The dorsal tubercle (7) is located just above the apex of the base. The

lateral and medial slopes including the apex form a smooth and regular dorsal articular margin of the base. At the sides, the lateral (11) and medial (5) tubercles of the base can be seen as bony protrusions.

Unlike the presence of a medial and lateral slope in the index and middle fingers, a palmar view (Figure 6.13b) of the ring finger shows a single convex palmar articular margin (16). The lateral (11) and medial (5) tubercles are associated with the articular margin at its lateral and medial sides respectively. Similar to the dorsal articular margin, the palmar articular margin is also smooth.

From a lateral view (Figure 6.13c) the lateral articular margin (18) slopes distally from the dorsal to the palmar surface. An oval-shaped lateral tubercle (11) extends from the dorsal to the palmar surface across the lateral margin.

In contrast to the lateral articular margin (Figure 6.13d), the medial articular margin (19) forms a shallow concave margin from dorsal to proximal. An oval-shaped medial tubercle (5) can be seen to extend from dorsal to palmar surfaces across the medial margin.

The articular surface (Figure 6.13f), is oval in shape. The medial articular margin is straight while the lateral articular margin is convex. Two shallow depressions can be seen which represent the relatively larger lateral (22) and relatively smaller medial (23) articular facets separated by a broad interarticular ridge. This is in contrast to the medial facets that were found to be larger in the index and middle fingers. An interesting observation is that if the ring finger is placed on its palmar surface very little if any tilting laterally is seen. If the same bone is placed on its dorsal surface, slight tilting to the medial aspect is seen.

#### **6.14.4 Siding**

In order to differentiate the right fourth middle phalanx from the corresponding one on the left side, the bone is orientated with the palmar surface facing down and the dorsal surface facing up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2000).

For the purpose of the present study, a list of bony landmarks on the shaft, head and base of the fourth middle phalanx will now be provided. This is to overcome any problems that may be encountered if only a fragment of the fourth middle phalanx is found amongst skeletal remains.

#### Shaft

1. Lateral margin is angulated (10) (Figures 6.13a and b)
2. Medial margin is concave and smooth (4) (Figures 6.13a and b)
3. Distal end of shaft rotated laterally (Figures 6.13a and b)

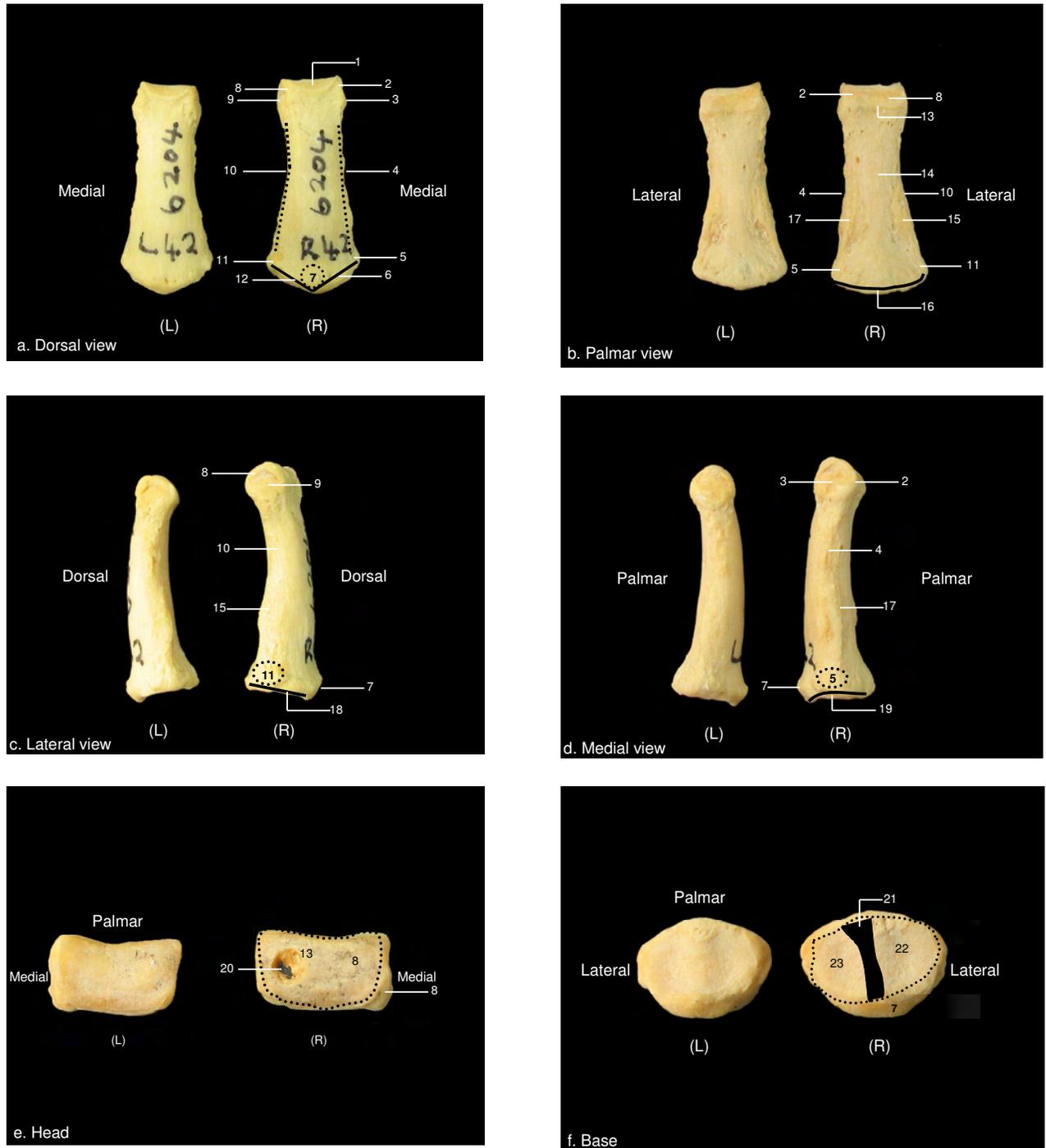
#### Head

1. Lateral condyle (8) extends more distally than the medial condyle (2) (Figures 6.13a and b)

#### Base

1. Lateral articular margin straight (18) (Figure 6.13c)
2. Medial articular margin concave proximally (19) (Figure 6.13d)

Figure 6.13: Morphology of the right (R) and left (L) fourth middle phalanx



1=dorsal articular margin of head, 2=medial condyle of head, 3=medial fossa of head, 4=medial margin of shaft, 5=medial tubercle of base, 6=dorsal medial slope of base, 7=dorsal tubercle of base, 8=lateral condyle of head, 9=lateral fossa of head, 10=lateral margin of shaft, 11=lateral tubercle of base, 12=dorsal lateral slope of base, 13=palmar articular margin of head, 14=palmar surface of shaft, 15=palmar lateral ridge of shaft, 16=palmar articular margin of base, 17=palmar medial ridge of shaft, 18=lateral articular margin of base, 19=medial articular margin of base, 20=artifact on head, 21=interarticular ridge of base, 22=lateral articular facet of base, 23=medial articular facet of base.

## **6.15 Morphology of the fifth middle phalanx (Figures 6.14a-f)**

### **6.15.1 Shaft or body (Figures 6.14a-d)**

The little finger is the shortest bone in the middle phalangeal series. The shaft is wider proximally than distally. The lateral margin (10) also shows angulation in the midshaft area as seen from a dorsal view (Figure 6.14a), but to a lesser extent when compared to the middle phalanges of the index, middle and ring fingers. The shaft is smooth along its entire length with sparsely scattered foramina at the proximal and distal end. The shaft is rotated slightly laterally in contrast to the medial rotation seen in the middle and ring fingers. A dorsal tubercle (7) is located above the apex which is formed by the union of the dorsal lateral (12) and dorsal medial (6) slopes of the base. The dorsal apex of the base is orientated medially rather than laterally as was the case in the index, middle and to a certain extent in the ring finger. This medial orientation of the apex results in a longer lateral and shorter medial slope of the articular margin of the base.

Features observed on a palmar view (Figure 6.14b) are similar to that identified on a dorsal view. These include the lateral (15) and medial (17) palmar ridges located on either side of the smooth palmar surface (14). The medial palmar ridge is more prominent and elongated than the less prominent, short lateral palmar ridge. The reverse is true for the index, middle and ring fingers.

From a lateral view (Figure 6.14c) the base is convex dorsally and concave on the palmar surface. The lateral margin (10) is smooth except for the rough palmar lateral ridge (15) which projects forward at the proximal end of the shaft. The shaft is also much broader proximally than distally.

Bony landmarks seen from a medial view of the shaft (Figure 16.4d), are similar to that described for the lateral view. In other words, the smooth medial margin (4) is interrupted by a rough palmar medial ridge (17) located at the proximal end of the shaft. The shaft is also relatively broader proximally than distally.

### 6.15.2 Head (Figures 6.14a-e)

Similar to what was observed on the middle phalanges of adjacent digits, a dorsal view (Figure 6.14a) shows a relatively small surface area of the head. The dorsal articular margin (1), a clearly marked line, converges towards the center. Lying on either side of this articular margin are the lateral (8) and medial (2) condyles. The medial condyle (2) extends further distally than the lateral condyle (8).

A greater surface area of the head can be seen from a palmar aspect (Figure 6.14b). A shallow groove separates the two condyles. The articular margin (13) is longer and straight when compared to the dorsal articular margin.

Due to the distal end of the shaft rotating more medially than the rest of the bone, only the lateral aspects of the head can be seen from a lateral view (Figure 6.14c). The lateral condyle (8) forms a thin rim of bone surrounding the lateral fossa (9).

The lateral and medial aspects of the head can be seen from a medial view (Figure 6.14d) due to rotation of the distal half of the shaft medially. The medial condyle (2) forms a thin rim of bone that surrounds the medial fossa (3).

The head is rectangular in shape from the articular end (Figure 6.14e). The head has greater length on the palmar and dorsal margins in comparison to the shorter medial and lateral margins. The medial condyle (2) stretches out more medially and forms a blunt margin. This tends to create a slope on the palmar margin.

### 6.15.3 Base (Figures 6.14a-d and f)

From a dorsal view (Figure 6.14a) the base presents with two slopes of different length, namely, a longer lateral (12) and a shorter medial (6) slope. At the point where the lateral and medial slopes meet, a round apex is formed. This apex is medially orientated. The dorsal tubercle (7) is located just above the apex of the base. The lateral and medial slopes, including the apex, form a smooth and regular dorsal articular margin of the base. At the sides, a lateral (11) and medial (5) tubercle of the base can be identified.

Similar to the ring finger, the little finger has a convex palmar articular margin (16) (Figure 6.14b) which is smooth. The lateral (11) and medial (5) tubercles are visible on each side.

From a lateral view (Figure 6.14c) the lateral articular margin (18) is straight from dorsal to palmar surfaces. An oval-shaped lateral tubercle (11) can be seen to extend from the dorsal to the palmar surface.

From a medial view (Figure 6.14d), the medial articular margin (19) also runs as a straight line from the dorsal to the palmar surface. An oval-shaped medial tubercle (5) can be seen to extend from the dorsal to the palmar surface.

The base is oval in shape when looked at from the articular end (Figure 6.14f). Two shallow concavities are visible. They represent the relatively larger lateral (22) and relatively smaller medial (21) articular facets separated by a broad interarticular ridge (20), similar to that observed in the ring finger. In contrast, the medial facet was relatively larger than the lateral facet in the index and middle fingers.

#### **6.15.4 Siding**

In order to differentiate the right fifth middle phalanx from the corresponding one on the left side, the bone is orientated with the palmar surface facing down and the dorsal surface facing up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2005).

For the purpose of the present study, a list of bony landmarks on the shaft, head and base of the fifth middle phalanx will now be provided. This is to overcome any problems that may be encountered if only a fragment of the fifth middle phalanx is found amongst skeletal remains.

#### Shaft

1. Lateral margin is angulated (10) (Figures 6.14a and b)

2. Shaft is rotated medially (Figures 6.14a, b and d)

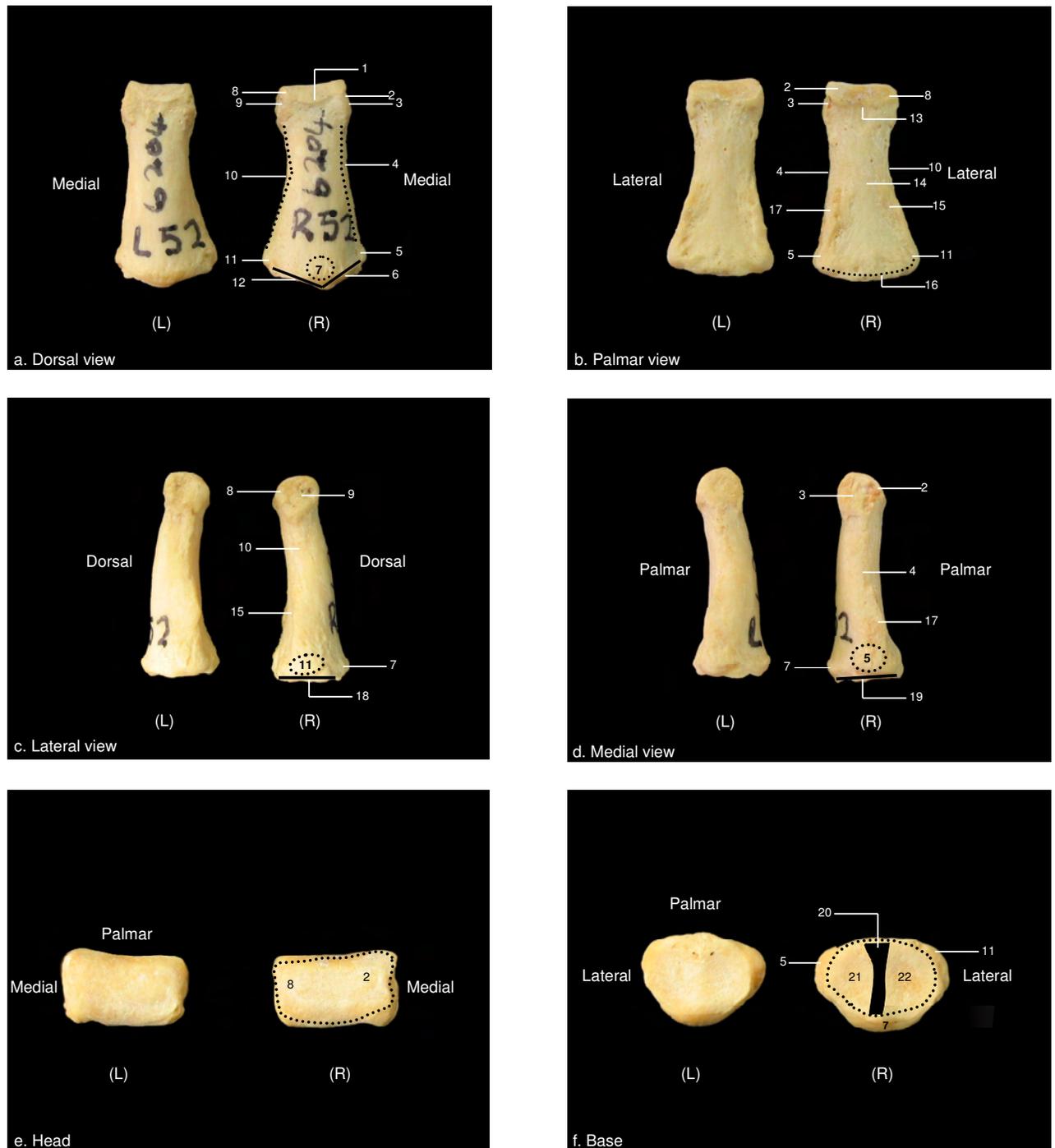
Head

1. Medial condyle (2) extends further distally than the lateral condyle (Figures 6.14a and b)
2. Medial condyle extends further medially and forms a blunt point than the lateral condyle (Figure 6.14e)

Base

1. Larger lateral articular facet (22) (Figure 6.14f)
2. Smaller medial articular facet (21) (Figure 6.14f)
3. Medial condyle more prominent than lateral condyle (Figure 6.14f)

Figure 6.14: Morphology of the right (R) and left (L) fifth middle phalanx



1=dorsal articular margin of head, 2=medial condyle of head, 3=medial fossa of head, 4=medial margin of shaft, 5=medial tubercle of base, 6=dorsal medial slope of base, 7=dorsal tubercle of base, 8=lateral condyle of head, 9=lateral fossa of head, 10=lateral margin of shaft, 11=lateral tubercle of base, 12=dorsal lateral slope of base, 13=palmar articular margin of head, 14=palmar surface of shaft, 15=palmar lateral ridge of shaft, 16=palmar articular margin of base, 17=palmar medial ridge of shaft, 18=lateral articular margin of base, 19=medial articular margin of base, 20=interarticular ridge of base, 21=medial articular facet of base, 22=lateral articular facet of base.

## 6.16 Morphology of the first distal phalanx (Figures 6.15a-f)

### 6.16.1 Shaft or body (Figures 6.15a-d)

A dorsal view (Figure 6.15a) shows that the shaft narrows at its distal end. The lateral (6) and medial (2) margins of the shaft are concave. The lateral margin extends further proximally than the medial margin. The latter tends to run obliquely in a palmar direction in the proximal third of the shaft. This gives the impression that the lateral margin is relatively longer than the medial margin. The dorsal surface is smooth except for a rough area at the proximal end of the dorsal surface which serves for attachment of the tendon of extensor pollicis longus (Scheuer & Black 2000). The distal end of the dorsal surface is smooth and deep to the fingernail (Wilkinson 1953). In the present study, numerous nutrient foramina were located at the proximal and distal ends of the shaft.

Unlike the smooth dorsal surface, the palmar surface (Figure 6.15b) is rough due to attachment of soft tissue structures in this region. This surface is also flattened at the proximal end (Wilkinson 1953). This surface presents with two concavities, namely, the smooth distal palmar surface (9) and the rough proximal palmar surface (11). The proximal palmar concavity (11) is for attachment of the flexor digitorum profundus tendon. On either side of the proximal palmar concavity (11) are two ridges located on the lateral and medial side of the shaft respectively. The lateral palmar ridge (10) is broader and extends further proximally than the medial palmar ridge (15).

The lateral surface of the shaft (Figure 6.15c) is broader proximally and tapers towards the distal end. The dorsal apex of the base (4) and the lateral tubercle of the base (7) can be identified.

A medial view (Figure 6.15d) of the shaft presents similar morphological features as seen on a lateral view. In other words, the shaft is also broader proximally and tapered distally. The dorsal apex of the base (4) and the medial tubercle of the base (3) can be identified from this view.

### **6.16.2 Head (Figures 6.15a-e)**

From a dorsal aspect (Figure 6.15a) the head presents as a narrow strip of rough bone along the distal end of the shaft which then extends proximally to overlap the lateral and medial aspects of the distal third of the shaft. Generally, the head is rough and irregular in shape.

A larger surface area of the rough and irregular-shaped head is seen from a palmar aspect (Figure 6.15b) in comparison to the dorsal view. The head surrounds the periphery of the distal third of the shaft as a broad rather than a narrow strip of bone. The lateral (8) and medial (14) extensions of the head on the shaft are broader than that seen from a dorsal aspect. The lateral and medial extensions tend to taper at their proximal free ends.

On a lateral and medial view (Figure 6.15c) the head is extended in a slightly dorsal direction. This may relate to function or perhaps to the mass of soft tissue padding that causes the distal phalanx of the thumb to be extended at its tip.

A superior view (Figure 6.15e) of the head shows very little with regards to morphological features that can be used for identification purposes. What is visible is an oval-shaped head which has greater width from medial to lateral than from dorsal to palmar surfaces.

### **6.16.3 Base (Figures 6.15a-d and f)**

A dorsal view (Figure 6.15a) shows that the base is wider than the rest of the bone. The proximal articular margin (5) is convex proximally, except at the lateral end which is concave forming a small step inwards. At the point where the base merges with the shaft, a straight margin is formed laterally while at its medial end the margin is convex. Due to the lateral margin projecting more proximally, the lateral part of the shaft including the base on this aspect is extended proximally. The bone thus appears to be tilted on the lateral side which gives the impression that the medial margin of the shaft including its base is set at a higher or

more distal level. The lateral (7) and medial (3) tubercles can be seen at either ends of the base.

When the bone is turned so that the palmar surface of the base is visible (Figure 6.15b), the articular margin of the base (13) is convex proximally. Associated with this margin is a centrally placed oval-shaped articular facet called the palmar articular facet of the base (12) for attachment of flexor pollicis longus (Netter 1989, plate 435, Drake *et al.* 2005). The lateral end of the base is broad, round and projects proximally in contrast to the narrow medial end which curves up in a distal direction. A few foramina may present randomly on the palmar aspect of the base. The lateral (7) and medial (3) tubercles are also visible from this view.

A lateral view of the base (Figure 6.15c) shows a straight lateral articular margin (16) running proximally from the dorsal to the palmar surface of the bone. This results in the palmar end of the margin projecting more proximally than at the dorsal end. This proximal extension makes it difficult to identify the medial articular margin. The dorsal apex of the base projects only slightly proximally thus giving this aspect of the base the appearance of a short and stout “beak” as opposed to an elongated “beak” seen in the index finger.

When the base is viewed from a medial aspect (Figure 6.15d), the medial articular margin (17) is seen as a shallow concavity running at the same level from the dorsal to the palmar surface. The lateral articular margin is also visible from a medial view as it projects further proximally than the medial articular margin.

The articular surface of the base (Figure 6.15f) is oval to round in shape. The palmar articular margin is longer than the dorsal articular margin. The lateral articular margin is straight and longer in comparison to the convex and shorter medial articular margin. The articular surface has a single shallow concavity (18). From this view, the relatively smaller lateral (7) and larger medial (3) tubercles are visible at the lateral and medial ends respectively. The palmar articular margin is interrupted by the presence of a small oval shaped articular facet (12) which is positioned more to the lateral than to the medial end.

#### 6.16.4 Siding

In order to differentiate the right first distal phalanx from the corresponding one on the left side, the bone is orientated with the palmar surface facing down and the dorsal surface facing up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2005).

For the purpose of the present study, a list of bony landmarks on the shaft, head and base of the first distal phalanx will now be provided. This is to overcome any problems that may be encountered if only a fragment of the first distal phalanx is found amongst skeletal remains.

##### Shaft

1. Lateral margin (6) has a longer slope which extends more proximally than medial margin (Figure 6.15a)
2. Medial margin (2) has a shorter slope than the lateral margin (Figure 6.15a)

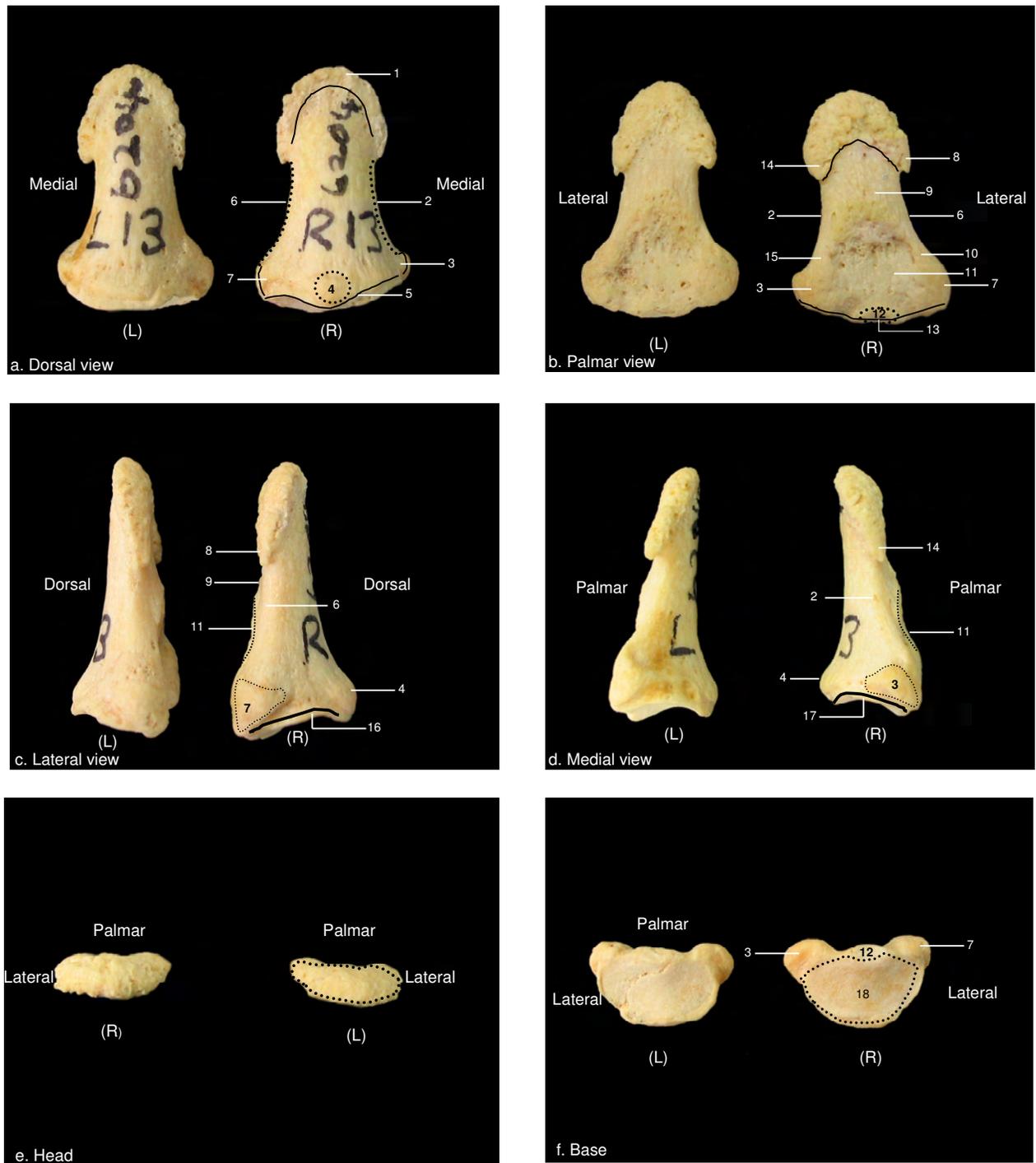
##### Head

1. Lateral extension of the head (8) is more proximally placed than the medial extension (14) of the head (Figures 6.15a and b). While the length of the lateral and medial extensions varies in this bone of different individuals, it is a bony landmark that can be used to side this bone.

##### Base

1. Lateral articular margin (16) which projects more proximally making it difficult to see the medial articular margin (Figure 6.15c)
2. Medial articular margin (17) more distally placed than the more proximally placed lateral articular margin (Figure 6.15d)
3. Palmar articular facet (12) positioned more laterally on the palmar articular margin (Figure 6.15b)

Figure 6.15: Morphology of the right (R) and left (L) first distal phalanx



1=head, 2=medial margin of shaft, 3=medial tubercle of base, 4=dorsal apex of base, 5=dorsal articular margin of base, 6=lateral margin of shaft, 7=lateral tubercle of base, 8=palmar lateral extension of head, 9=smooth distal palmar surface of shaft, 10=palmar lateral ridge of shaft, 11=rough proximal palmar concavity of shaft, 12=palmar articular facet of base, 13=palmar articular margin of base, 14=palmar medial extension of head, 15=palmar medial ridge of shaft, 16=lateral articular margin of base, 17=medial articular margin of base, 18=articular facet of base.

## 6.17 Morphology of the second distal phalanx (Figures 6.16a-f)

### 6.17.1 Shaft or body (Figures 6.16a-d)

The shaft is convex on its dorsal aspect and concave on the palmar surface (Scheuer & Black 2000). From a dorsal view (Figure 6.16a) the proximal end is broad while the distal end is tapered (Scheuer & Black 2000). The lateral (6) and medial (2) margins are concave. The lateral margin projects further proximally than the medial margin. The dorsal surface is smooth throughout its entire length. Very few, if any, nutrient foramina can be identified on the dorsal aspect.

A view of the palmar surface (Figure 6.16b) shows that the shaft is rough proximally and smooth distally. The rough surface presents as a shallow depression, called the rough palmar concavity (12) which serves as an attachment site for the tendon of flexor digitorum profundus (Gray 1959, Netter 1989, Drake *et al.* 2005). On either side of this rough area, the smooth lateral (11) and medial (16) ridges can be identified. The medial palmar ridge is relatively broader than the lateral palmar ridge. Furthermore, the medial margin at its proximal end tends to curve distally while the lateral margin at its proximal end projects either horizontally or further proximally. Both the lateral and medial margins are concave.

The lateral aspect of the shaft (Figure 6.16c) shows a smooth lateral margin. The greater width is seen at the proximal end. The dorsal surface is concave proximally and convex distally. The proximal end forms a slope as it approaches the base. The rough proximal palmar concavity (12) represents the depression in the middle. Distal to this concavity is the smooth palmar surface of the shaft (10).

Observing the shaft from a medial aspect (Figure 6.16d) reveals a smooth medial margin. Features that are observed from a lateral view can also be seen from a medial view. These include the proximal concavity and distal convexity of the dorsal surface, the rough proximal palmar concavity (12) in the midshaft region and the smooth palmar surface (10) located distal to the proximal palmar concavity (12).

### 6.17.2 Head (Figures 6.16a-e)

From a dorsal aspect (Figure 6.16a) the head presents as a narrow strip of rough bone along the distal margin which extends proximally to overlap the lateral and medial aspects of the distal third of the shaft.

A larger surface area of the head is seen from a palmar aspect (Figure 6.16b) in comparison to the dorsal view. The head also surrounds the periphery of the distal third of the shaft as a broad region rather than a narrow strip of bone. The lateral and medial extensions of the head on the shaft are broad distally and tapered proximally. Randomly placed nutrient foramina can be identified along the inferior margin of the head.

On a lateral view (Figure 6.16c), the head is flexed rather than extended as in the case of the thumb. Lateral rotation at the distal end of this bone results in both the lateral (9) and medial (15) palmar extensions of the head being visible.

From a medial view (Figure 6.16d), only the medial palmar extension (15) can be identified. Slight flexion of the head, as seen from a lateral view, is also evident from a medial aspect.

The non-articular distal surface (Figure 6.16e) reveals an oval shaped head. No other detail is noted.

### 6.17.3 Base (Figures 6.16a-d and f)

From a dorsal view (Figure 6.16a), the base is recognized by having a lateral (8) and medial (4) slope which merges to form the dorsal apex (5) of the base. The lateral slope is longer in comparison to the shorter medial slope. The difference in length of the slopes causes the apex of the base to be shifted in a more medial direction. The lateral (7) and medial (3) tubercles can be seen to overlap onto the dorsal surface.

The articular margin of the base as seen from a palmar view (Figure 6.16b) also shows the presence of two slopes. In this case the medial slope (17) is relatively longer than the lateral (13) slope. The point where these two slopes meet is called the palmar apex of the base

(14). The apex of the base is shifted in a more lateral direction as a result of the relatively longer medial slope of the base. The relatively larger medial (3) and smaller lateral (7) tubercles can be seen to overlap onto the palmar aspect.

From a lateral view (Figure 6.16c) the lateral articular margin (18) is concave proximally. The dorsal apex of the base projects further proximally thus increasing the curvature of the lateral articular margin giving it the appearance of an elongated “beak”. The dorsal (5) and palmar (14) apex of the base can be seen from this view.

From a medial view (Figure 6.16d) the medial articular margin (19) is less concave in comparison to the lateral articular margin. In fact, some of the bones observed showed that this margin may be straight for most of its length. That part of the margin closest to the palmar surface tends to curve proximally and this may sometimes give the appearance that the medial articular margin is concave in shape. The dorsal and palmar apex of the base can also be seen from this view.

From an inferior view (Figure 6.16f) the base is oval in shape. The lateral tubercle (7) is relatively larger than the medial tubercle (3) of the base.

#### **6.17.4 Siding**

In order to differentiate the right second distal phalanx from the corresponding one on the left side, the bone is orientated with the palmar surface facing down and the dorsal surface facing up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2005).

For the purpose of the present study, a list of bony landmarks on the shaft, head and base of the second distal phalanx will now be provided. This is to overcome any problems that may be encountered if only a fragment of the second first distal phalanx is found amongst skeletal remains.

Shaft

1. Lateral margin (6) projects further proximally than the medial margin (Figures 6.16a and b)
2. Medial palmar ridge (16) thicker than lateral palmar ridge (11) (Figure 6.16b)

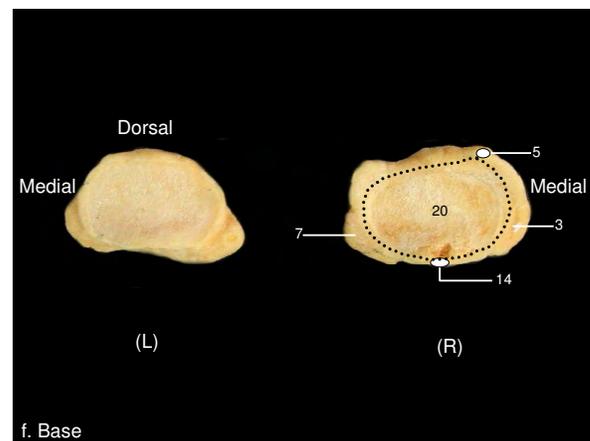
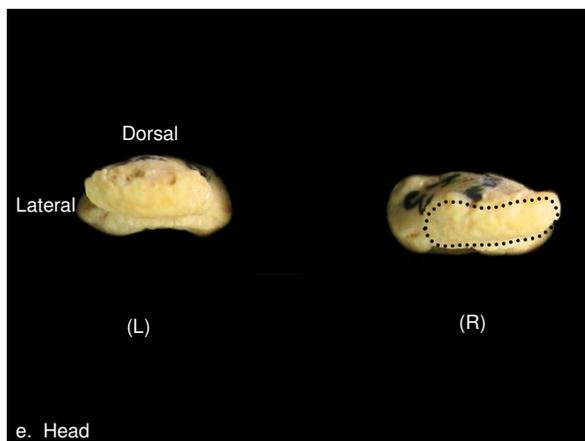
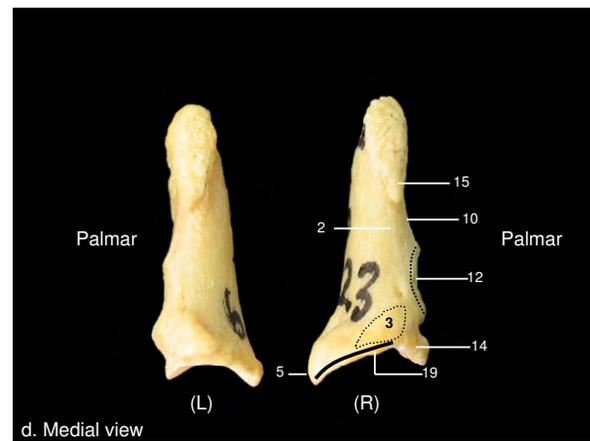
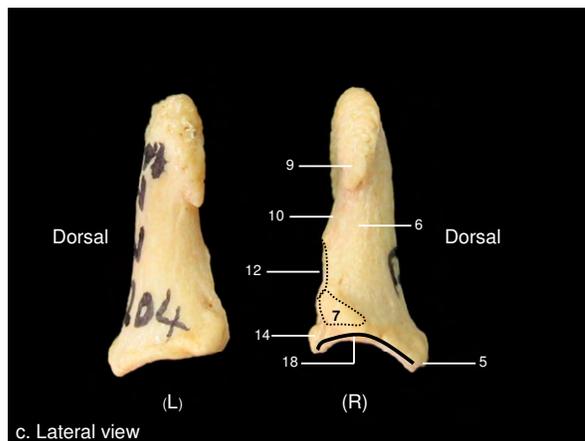
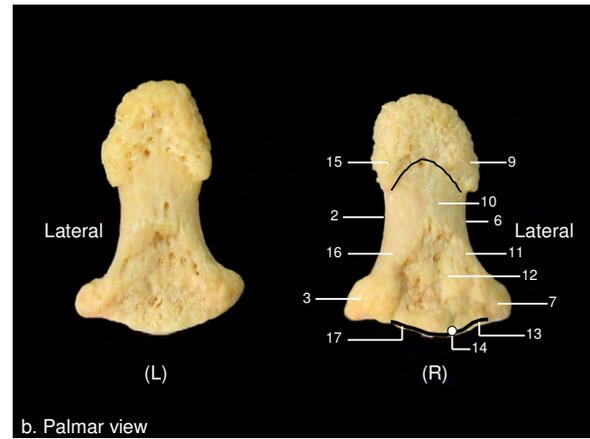
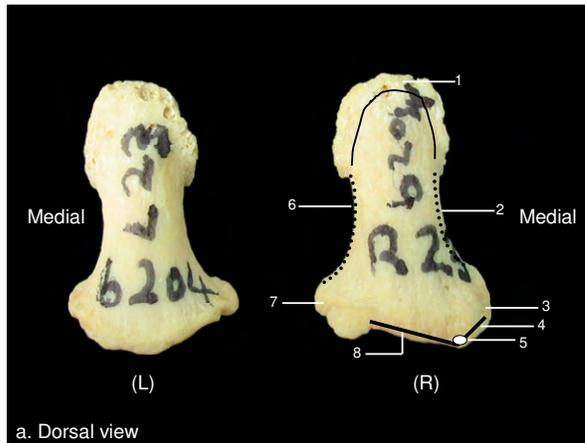
Head

1. Lateral extension of head (9) broader than medial extension (15) (Figure 6.16a)

Base

1. Longer lateral slope (8) (Figure 6.16a)
2. Shorter medial slope (4) (Figure 6.16a)
3. Dorsal apex (5) shifted more medially (Figure 6.16a)
4. Longer medial slope (17) (Figure 6.16b)
5. Shorter lateral slope (13) (Figure 6.16b)
6. Lateral articular margin (18) concave (Figure 6.16c)
7. Medial articular margin (19) varies from slightly concave to straight (Figure 6.16d)

Figure 6.16: Morphology of the right (R) and left (L) second distal phalanx



1=head, 2=medial margin of shaft, 3=medial tubercle of base, 4=dorsal medial slope of base, 5=dorsal apex of base, 6=lateral margin of shaft, 7=lateral tubercle of base, 8= dorsal lateral slope of base, 9=palmar lateral extension of head, 10=smooth distal palmar surface of shaft, 11=palmar lateral ridge of shaft, 12=rough proximal palmar concavity, 13=palmar lateral slope of base, 14=palmar apex of base, 15=palmar medial extension of head, 16=palmar medial ridge of shaft, 17=palmar medial slope of base, 18=lateral articular margin of base, 19=medial articular margin of base, 20=articular facet of base.

## **6.18 Morphology of the third distal phalanx (Figures 6.17a-f)**

### **6.18.1 Shaft or body (Figures 6.17a-d)**

The distal phalanx of the middle finger is relatively smaller than that of the thumb and index finger, but relatively bigger than that of the ring and little finger. On the dorsal surface (Figure 6.17a), the shaft is smooth throughout its entire length. Proximally, the shaft is broad while distally it is tapered (Scheuer & Black 2000). Lateral (6) and medial (2) margins are concave in shape. There is relatively greater length of the lateral margin as it extends further proximally than the medial margin. Very few, if any, nutrient foramina can be identified at the proximal and distal ends.

On the palmar aspect (Figure 6.17b), the shaft is smooth distally (10). The concave lateral margin (6) extends further proximally than the concave medial margin (2). The proximal depression is referred to as the rough, proximal palmar concavity (12). It is flanked on each side by smooth, lateral (11) and medial (16) ridges. The palmar medial ridge is relatively broader than the palmar lateral ridge. Numerous nutrient foramina can be seen in the proximal palmar concavity. This concavity serves for attachment of the flexor digitorum profundus tendon.

From a lateral view (Figure 6.17c), the dorsal surface is concave proximally and slightly convex distally. The palmar surface, on the other hand, shows the rough proximal concavity (12) while distally, a slope can be identified which represents the smooth palmar surface. The lateral surface is relatively smooth. The shaft is wider proximally and tapered distally.

The medial margin of the shaft, as seen from a medial view (Figure 6.17d), is smooth. The dorsal and palmar surfaces present the same as observed from a lateral view.

### **6.18.2 Head (Figures 6.17a-e)**

From a dorsal aspect (Figure 6.17a), the head presents as a narrow strip of rough bone along the distal margin of the shaft. The head gives off extensions in a proximal direction which overlaps the lateral and medial aspects of the distal third of the shaft with the lateral extension

being relatively broader than the medial extension. The head takes on a round shape similar to that of the index finger. Also noticeable from this view is that the head is pulled into extension and slight lateral rotation.

As is the case in the thumb and index finger, a greater surface area of the head is visible from a palmar (Figure 6.17b) than from a dorsal view. The head forms a broad peripheral band at the distal end of the shaft. The lateral (9) and medial (15) extensions are broader than that observed from the dorsal aspect. The lateral extension projects further proximally than the medial extension. Both the lateral and the medial extensions are tapered at their ends and not attached to either the lateral or medial margins of the shaft. A few foramina can be seen just proximal to the head where it merges with the shaft. The extension of the head, with slight lateral rotation is also seen from this view.

On a lateral view (Figure 6.17c) the medial rotation of the head is not obvious. Instead, the head and distal end of the shaft is aligned in an almost straight line in comparison to the slight extension and flexion seen in the thumb and index fingers respectively. The lateral palmar extension of the head (9) with its tapered free edge can be easily identified from this view.

From a medial view (Figure 6.17d), the alignment of the head and distal end of the shaft is exactly the same as that described from a lateral view. The medial palmar extension of the head (15) with its free tapered edge can also be easily seen.

The non-articular end (Figure 6.17e) reveals a rectangular-shaped head with the greatest width from side to side.

### **6.18.3 Base (Figures 6.17a-d and f)**

From a dorsal view (Figure 6.17a), the dorsal articular margin presents as an irregular convex margin extending from side to side. This margin has two slopes, namely, the dorsal lateral (8) and dorsal medial (4) slope which join to form the dorsal apex of the base (5). These slopes are of equal length.

The articular margin of the base as observed from a palmar view (Figure 6.17b), shows a relatively short lateral (13) and relatively longer medial (17) slope. This difference in length of the slopes may be due to the lateral margin of the shaft and base lifted in a proximal direction while the medial margin of the shaft tends to be pulled distally. Where the two slopes meet, a round apex is formed which is directed slightly laterally. The lateral and medial tubercles overlap onto the palmar surface.

From a lateral view (Figure 6.17c) the lateral articular margin (18) varies from a straight to a slightly concave margin, similar to that observed in the thumb. The apex on the palmar aspect of the base does not extend further proximally as is the case in the thumb. The apex of the dorsal (5) and palmar (14) surfaces of the base can be seen from this view. The elongated lateral tubercle of the base (7) is obliquely positioned just distal to the articular margin.

Features from a medial view (Figure 6.17d) are similar to that seen on a lateral view. The difference is that the medial articular margin (19) is slightly concave and set at a higher or more distal level than the lateral articular margin which makes the lateral margin also visible from a medial view. The medial tubercle (3) of the base is triangular in shape.

The articular surface (20) of the base (Figure 6.17f) is rectangular in shape. The dorsal and palmar margins are relatively longer than the lateral and medial margins. The lateral (7) and medial (3) tubercles can be easily identified on the sides. The apex on the palmar aspect (14) is shifted laterally in comparison to the centrally placed apex on the dorsal surface (5).

#### **6.18.4 Siding**

In order to differentiate the right third distal phalanx from the corresponding one on the left side, the bone is orientated with the palmar surface facing down and the dorsal surface facing up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2005).

For the purpose of the present study, a list of bony landmarks on the shaft, head and base of the third distal phalanx will now be provided. This is to overcome any problems that

may be encountered if only a fragment of the third distal phalanx is found amongst skeletal remains.

### Shaft

1. Lateral margin (6) extends further proximally than the medial (12) margin (Figures 6.17a and b)
2. Palmar medial palmar (16) ridge relatively broader than palmar lateral (11) ridge (Figure 6.17b)

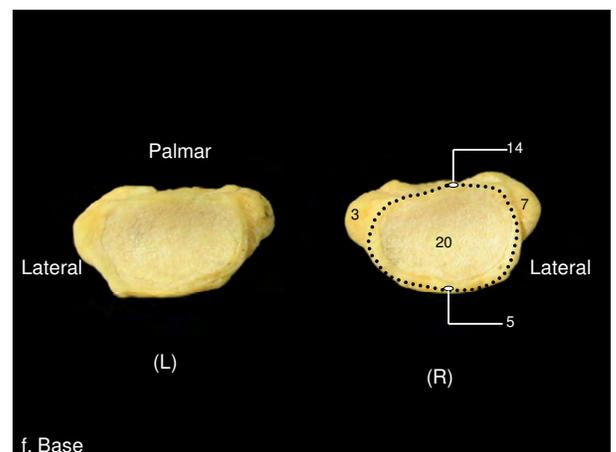
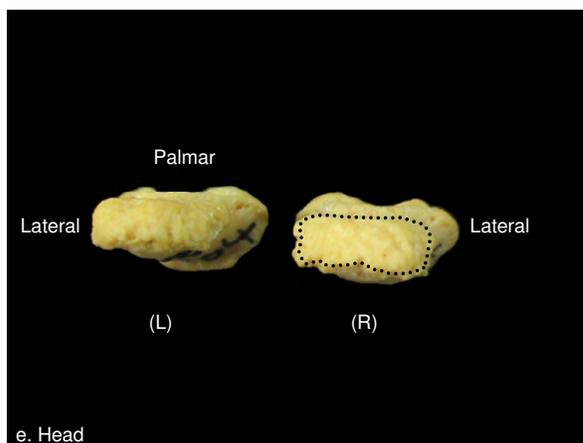
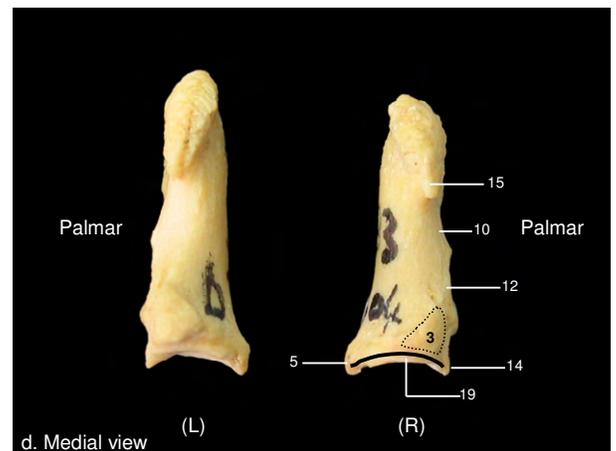
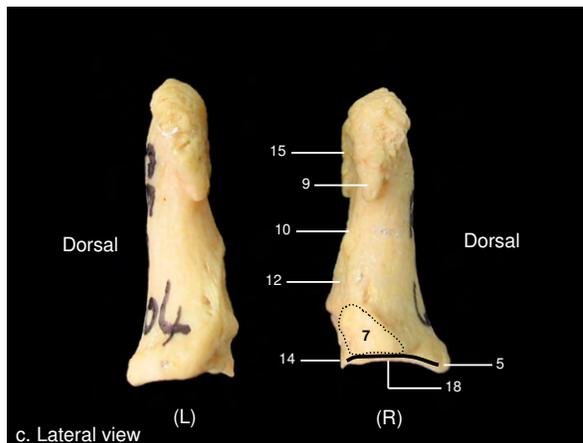
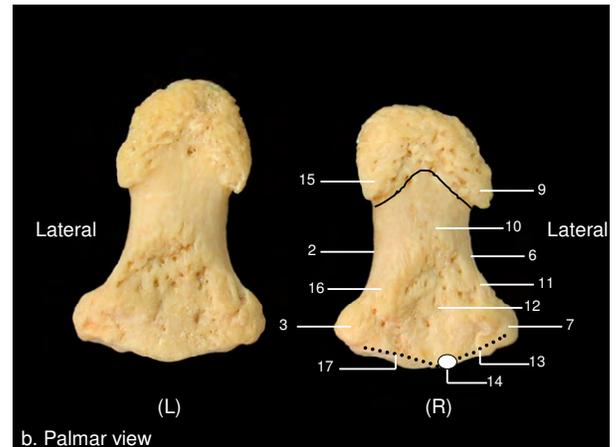
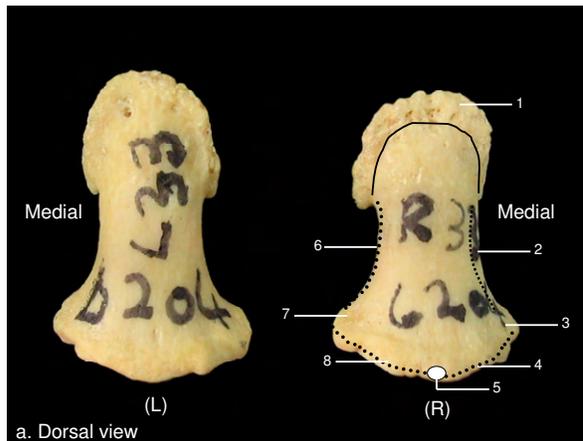
### Head

1. The lateral extension (9) is relatively broader than the medial extension (15) (Figure 6.17a)
2. The lateral extension (9) projects further proximally than the medial extension (15) (Figure 6.17b)
2. Head is extended and medially rotated on the shaft (Figure 6.17a and b)

### Base

1. Shorter lateral (13) and longer medial (17) slope of palmar articular margin (Figure 6.17b)
2. Lateral tubercle (7) elongated in an oblique manner (Figure 6.17c)
3. Medial tubercle (3) triangular in shape (Figure 6.17d)

Figure 6.17: Morphology of the right (R) and left (L) third distal phalanx



1=head, 2=medial margin of shaft, 3=medial tubercle of base, 4=dorsal medial slope of base, 5=dorsal apex of base, 6=lateral margin of shaft, 7=lateral tubercle of base, 8=dorsal lateral slope of base, 9=palmar lateral extension of head, 10=smooth distal palmar surface of shaft, 11=palmar lateral ridge of shaft, 12=rough proximal palmar concavity of shaft, 13=palmar lateral slope of base, 14=palmar apex of base, 15=palmar medial extension of head, 16=palmar medial ridge of shaft, 17=palmar medial slope of base, 18=lateral articular margin of base, 19=medial articular margin of base, 20=articular facet of base.

## **6.19 Morphology of the fourth distal phalanx (Figures 6.18a-f)**

### **6.19.1 Shaft or body (Figures 6.18a-d)**

The distal phalanx of the ring finger is relatively shorter than that of the middle finger. From a dorsal view (Figure 6.18a) the shaft is smooth along its entire length. The shaft is broadest at the proximal end and tapered distally. The lateral (6) and medial (2) margins are concave. The lateral margin is relatively shorter than the medial margin. Numerous foramina are seen at the distal end compared to the sparsely scattered foramina that can be identified at the proximal end.

The palmar aspect (Figure 6.18b) of the shaft is smooth distally (10) and rough proximally (12). The latter serves for the attachment of the flexor digitorum profundus tendon associated with the ring finger. On either side of this concavity are two ridges, namely the lateral (11) and medial (16) palmar ridges. The bones that were studied showed great variability in the thickness of these ridges. One ridge was not necessarily broader in width than the other. As observed in the thumb, index and middle fingers, the lateral (6) and medial (2) margins are concave with the medial margin extending further proximally than the lateral margin. This feature is more obvious on the palmar than on the dorsal aspect.

On a lateral view (Figure 6.18c) the dorsal surface is convex in the distal third and concave in the proximal two thirds. The palmar surface, on the other hand, forms a slope (10) in the distal half and a concavity (12) in the proximal half.

Morphology of this bone from a medial view (Figure 6.18d), is exactly the same as that described from a lateral view. One distinguishing feature is that the shaft is rotated medially.

### **6.19.2 Head (Figures 6.18a-e)**

From a dorsal aspect (Figure 6.18a), the head presents as a narrow strip of rough bone along the distal margin of the shaft. The head takes on a round shape similar to that of the index and middle fingers.

A greater surface area of the head is seen from a palmar view (Figure 6.18b). The head forms a broad area along the periphery of the shaft's distal end. The head forms lateral (9) and medial (15) extensions along the sides of the distal end of the shaft. Both the lateral and the medial extensions are tapered at their extreme ends. Numerous large nutrient foramina are found scattered on the palmar aspect of the head including its extensions.

On a lateral view (Figure 6.18c) the rotation of the head medially is not as marked as is seen in the middle finger. The non-articulating distal end is only slightly extended. The remainder of the head is positioned obliquely on the distal end of the shaft. The lateral extension (9), with its free tapered end, can be easily identified.

A medial view of the head (Figure 6.18d) is the same as that seen on a lateral view. The difference is that with the head rotated medially, both its medial (15) and lateral (9) extensions can be seen.

A superior view (Figure 6.18e) of the head shows that it is oval-shaped. The lateral end is broader in comparison to the narrow medial end. No additional identifying features can be described from this view.

### **6.19.3 Base (Figures 6.18a-d and f)**

Features of the base from a dorsal view (Figure 6.18a), shows an irregular dorsal articular margin (5). This margin is flanked on each side by a dorsal lateral (8) and dorsal medial (4) slope. The medial slope is relatively longer than the lateral slope. The straight and sloped margins are joined in such a way that it gives the dorsal articular margin a convex shape.

The articular margin on a palmar view (Figure 6.18b), is smooth in comparison to the irregular shaped dorsal articular margin. The palmar articular margin has two slopes, namely, a palmar lateral (13) and palmar medial (17) slope which join each other to form a rounded apex (14). The medial slope is relatively longer than the lateral slope. This difference in length of the slopes may be due to the lateral margin of the shaft and base being pulled in a proximal

direction, creating a deeper lateral curvature of the shaft while the medial of the shaft tends to be pulled distally thus stretching the curvature of the medial margin of the shaft.

From a lateral view (Figure 6.18c) the lateral articular margin (18) is concave and set at a higher or more distal level than the medial articular margin (19). In other words, a lateral view exposes part of the medial articular margin as well. The curvature described for the ring finger is similar to that of the thumb and index finger in that it is concave proximally. The difference comes in the projection of the apices on the dorsal and palmar aspect of the base. For example, in the thumb, the apex on the palmar surface projects further proximally than the apex on its dorsal surface. In the index finger, it is the apex of the dorsal surface that projects further proximally than the apex on its palmar surface. In the ring finger neither the dorsal nor the palmar apex projects further proximally than the other. In other words, the dorsal and palmar apices occur at the same level. The lateral tubercle (7) is located distal to the smooth articular margin and is relatively bigger than the medial tubercle (3).

From a medial view (Figure 6.18d), the articular margin (19) presents as a shallow concavity which is directed proximally. The medial tubercle of the base (3) is distal to the medial articular margin of the base.

The articular end (Figure 6.18f) shows an oval to rectangular shaped base. The palmar articular margin is relatively longer than the dorsal articular margin. The medial and lateral articular margins are convex in shape. The palmar apex (14) separates the relatively longer palmar medial slope from the relatively shorter palmar lateral slope. These slopes are indicated by a solid black line on the figure. The dorsal articular margin (5), lateral (8) and medial (4) slopes gives the dorsal margin a convex shape. The lateral tubercle of the base (7) is relatively larger than the medial tubercle (3). The articular surface (20) is seen as a shallow central depression.

#### **6.19.4 Siding**

In order to differentiate the right fourth distal phalanx from the corresponding one on the left side, the bone is orientated with the palmar surface facing down and the dorsal surface

facing up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2005).

For the purpose of the present study, a list of bony landmarks on the shaft, head and base of the fourth distal phalanx will now be provided. This is to overcome any problems that may be encountered if only a fragment of the fourth distal phalanx is found amongst skeletal remains.

#### Shaft

1. Medial margin (2) projects further proximally than the lateral margin (6) (Figures 6.18a and b)

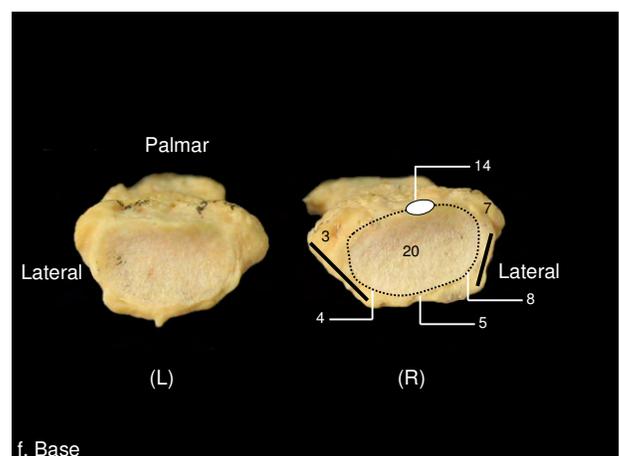
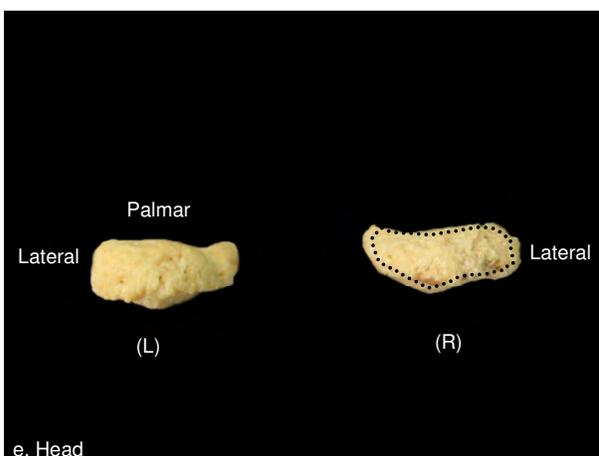
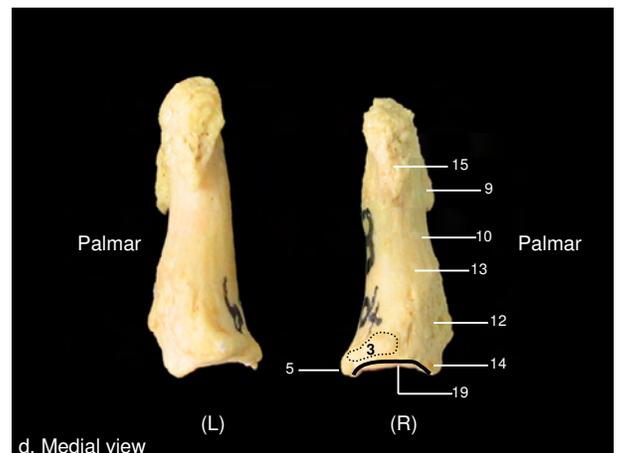
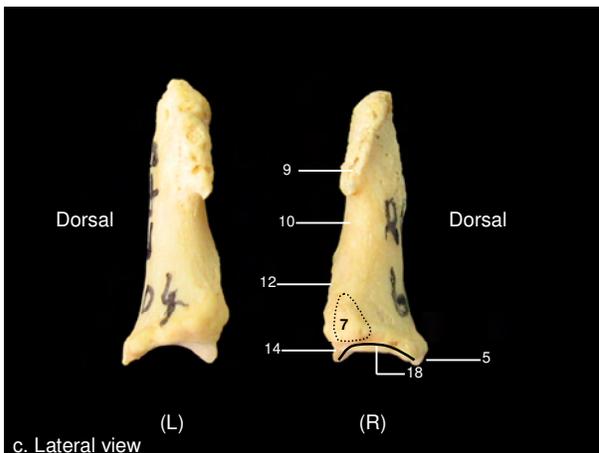
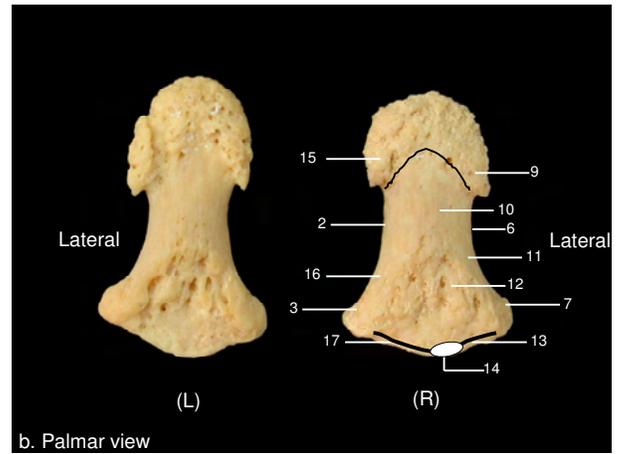
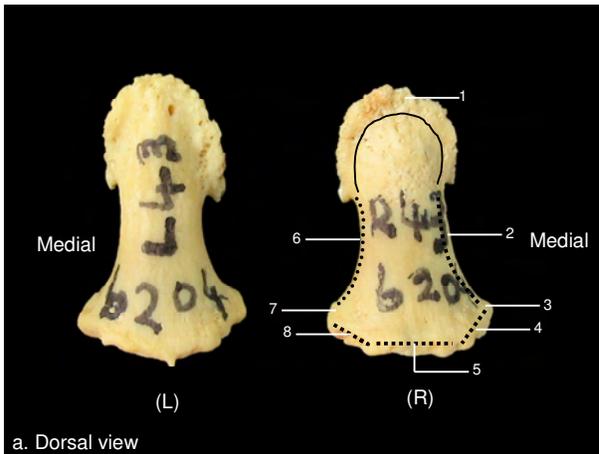
#### Head

1. Lateral extension (9) is broader and projects more proximally than the medial extension (15) (Figure 6.18b)

#### Base

1. Medial slope (4) relatively longer than the lateral slope (8) (Figures 6.18a and b)
2. Lateral articular margin (18) has a deep concavity and projects more distally exposing part of the medial articular margin (Figures 6.18c)
3. Medial articular margin (19) has a shallow concavity (Figures 6.18d)
4. Lateral tubercle (7) relatively larger than medial tubercle (3) (Figures 6.18a, b and f)

Figure 6.18: Morphology of the right (R) and left (L) fourth distal phalanx



1=head, 2=medial margin of shaft, 3=medial tubercle of base, 4=dorsal medial slope of base, 5=dorsal articular margin of base, 6=lateral margin of shaft, 7=lateral tubercle of base, 8=dorsal lateral slope of base, 9=palmar lateral extension of head, 10=smooth distal palmar surface of shaft, 11=palmar lateral ridge of shaft, 12=rough proximal palmar concavity of shaft, 13=palmar lateral slope of base, 14=palmar apex of base, 15=palmar medial extension of head, 16=palmar medial ridge of shaft, 17=palmar medial slope of base, 18=lateral articular margin of base, 19=medial articular margin of base, 20=articular facet.

## 6.20 Morphology of the fifth distal phalanx (Figures 6.19a-f)

### 6.20.1 Shaft or body (Figures 6.19a-d)

In the present study, the shaft of the fifth distal phalanx was the shortest and narrowest in comparison to adjacent distal phalanges. The shaft of this bone, as seen from a dorsal view (Figure 6.19a), is smooth along its entire length. The proximal end is broad in comparison to the tapered distal end. The lateral margin (6) has a deeper concavity in comparison to the more shallow concavity of the medial margin (2). Very few, if any, nutrient foramina are present at the proximal end of the shaft.

The palmar aspect (Figure 6.19b) shows a smooth distal surface (10) and a rough proximal palmar concavity (12). The rough area serves for the attachment of the flexor digitorum profundus tendon associated with the little finger. Two ridges are associated with the rough area, namely, the broader palmar medial (16) and narrow palmar lateral ridges (11). The shaft appears to be tilted to the lateral side due to the shorter lateral and longer medial margins. Not only is the shaft tilted laterally, but it is also medially rotated. Few nutrient foramina can be identified at the proximal end while distally, very few of these foramina are present. In the photograph taken of the right distal phalanx, a single large nutrient foramen was present just proximal to the solid line that outlined the shape of the lateral (9) and medial (15) extensions of the head.

The lateral aspect of the shaft (Figure 6.19c) shows a smooth lateral margin. The distal end of the shaft is pulled into slight flexion in a palmar direction. The smooth lateral margin, broad proximal and tapered distal end of the shaft is a general observation for the lateral views of all distal phalanges. The dorsal surface is convex in the distal half and slightly concave in the proximal half. The palmar surface has a deep concavity distally which is represented by the smooth palmar surface (10) and a rather shallow concavity proximally which is the proximal palmar concavity (12).

Features seen on a medial view (Figure 6.19d), is the same as that identified from a lateral view. What is different between the two views is that medial rotation of the shaft can be

more easily seen from a medial than from a lateral view with a greater part of the palmar surface is exposed.

### **6.20.2 Head (Figures 6.19a-e)**

From a dorsal aspect (Figure 6.19a) the head presents as a narrow strip of rough bone along the distal margin of the shaft. The head is much narrower when compared to that of adjacent fingers. In most of the samples examined, wearing down of the head appears to affect the lateral rather than the medial aspect of the head.

More of the head can be viewed from a palmar aspect (Figure 6.19b) than from the dorsal aspect. Not only does the head form a broad area along the periphery of the distal end of the shaft, it has lateral (9) and medial (15) extensions along the sides of the distal end of the shaft. Both the lateral and the medial extensions are tapered at their extreme ends. The medial extension projects more proximally than the lateral extension. Numerous tiny foramina are found scattered on the palmar aspect of the head, including its extensions.

On a lateral view (Figure 6.19c), the rotation of the head medially is similar to that observed in the middle finger. The head also displays slight flexion from this angle. The lateral palmar extension (9) can be easily identified by its tapered end.

A medial view (Figure 6.19d) shows the medial rotation very clearly as both the lateral (9) and medial (15) extensions of the head are visible. The head also displays slight flexion from this angle, similar to that observed from a lateral view.

The non-articular end (Figure 6.19e) shows a rectangular shaped head. The palmar and dorsal margins are relatively longer than the medial and lateral margins.

### **6.20.3 Base (Figures 6.19a-d and f)**

From a dorsal view (Figure 6.19a) the base is recognized by having a lateral (8) and medial (4) slope which merge to form the dorsal apex (5) of the base. The lateral slope is relatively longer in comparison to the relatively shorter medial slope. This finding was similar to

that observed in the index finger. This difference in length of the slopes causes the apex of the base to be positioned in a more medial direction. Generally, the articular margins are smooth.

The articular margin of the base identified from a palmar view (Figure 6.19b), has two slopes. The lateral (13) and medial (17) slopes, which together form the palmar articular margin, is set at a higher or more distal level than the dorsal lateral and dorsal medial slopes. This results in the dorsal articular margin being visible from a palmar view. This is not the case in the index finger, where the lateral and medial slopes on the palmar and dorsal aspects are at the same level. The medial slope is relatively shorter than the lateral slope. This difference in slope length causes the palmar apex (14) to be more medially placed.

A lateral view (Figure 6.19c) shows that the lateral articular margin (18) forms an oblique line running distally from the dorsal to the palmar surface. The upward slope of this margin results in the medial articular margin also being visible. The lateral tubercle (7) is triangular in shape and relatively smaller than the medial tubercle (3).

From a medial view (Figure 6.19d), the medial articular margin (19) forms a straight line. The medial tubercle (3) is relatively larger than the lateral tubercle.

A view of the articular end (Figure 6.19f), reveals an oval shaped concave surface. The dorsal margin is relatively longer than the palmar margin with the lengths of the lateral and medial margins being the shortest. Both the dorsal and palmar apices are more medially positioned. The dorsal and palmar lateral slopes are relatively longer than the medial slopes on the same surfaces. The medial tubercle (3) of the base is more elongated and projects further medially than the relatively smaller lateral tubercle (7).

#### **6.20.4 Siding**

In order to differentiate the right fifth distal phalanx from the corresponding one on the left side, the bone is orientated with the palmar surface facing down and the dorsal surface facing up or towards one, while the head is placed at the top end and the base at the bottom end (Bass 1995, Matshes *et al.* 2005).

For the purpose of the present study, a list of bony landmarks on the shaft, head and base of the fifth distal phalanx will now be provided. This is to overcome any problems that may be encountered if only a fragment of the fifth distal phalanx is found amongst skeletal remains.

### Shaft

1. Lateral margin (6) has a deep concavity (Figures 6.19a and b)
2. Medial margin (2) has a shallow concavity that projects more proximally than the lateral margin (Figures 6.19a and b)

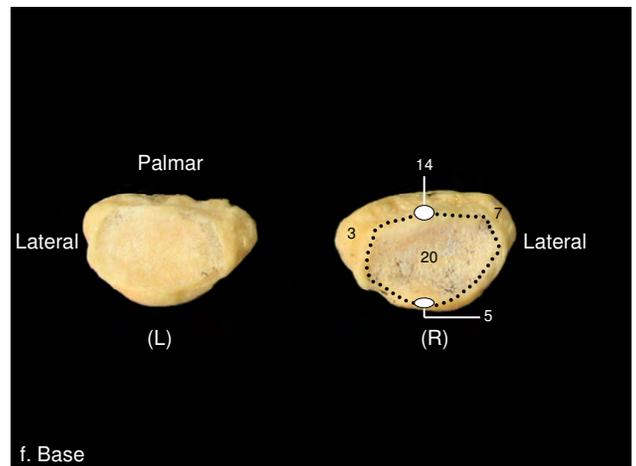
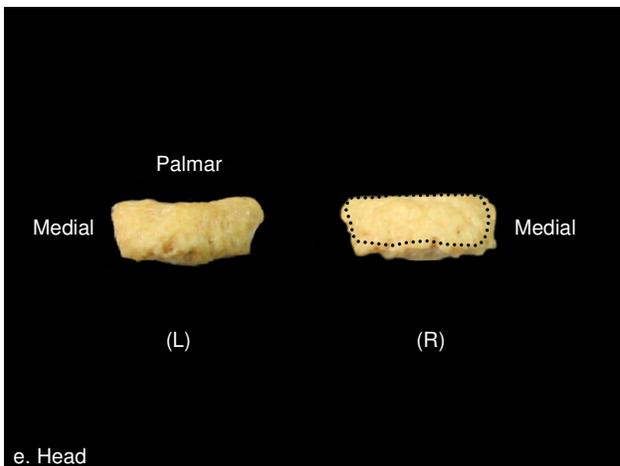
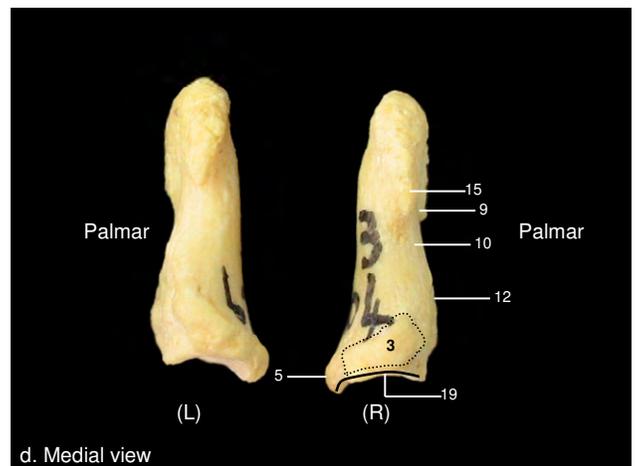
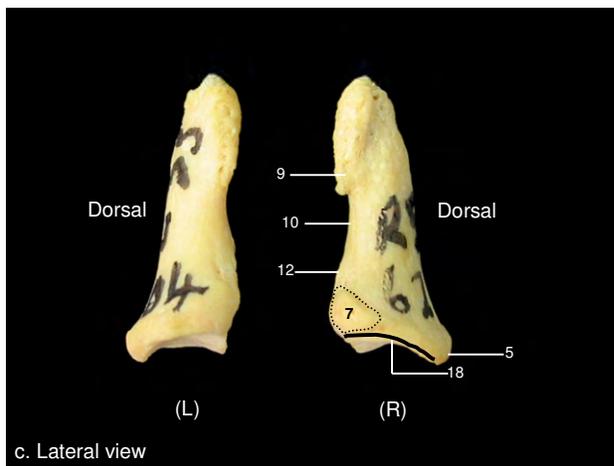
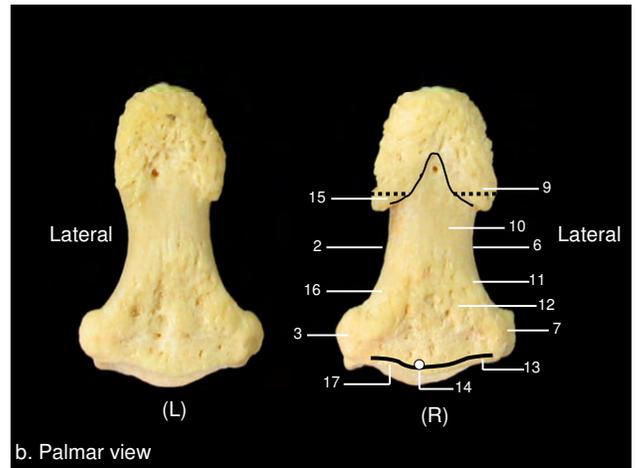
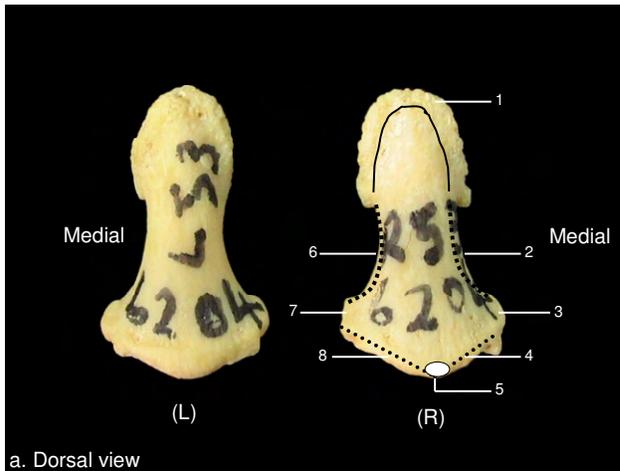
### Head

Lateral extension (9) slightly broader than the medial extension (15) (Figure 6.19b broken line)

### Base

1. Lateral slope of the dorsal and palmar articular margins is relatively long (Figures 6.19a, b and f)
2. Medial slope of the dorsal and palmar articular margins is relatively short (Figures 6.19a, b and f)
3. The palmar articular margin is set at a more distal level than the dorsal articular margin (Figure 6.19b)
4. Medial tubercle (3) relatively larger than lateral tubercle (7)

Figure 6.19: Morphology of the right (R) and left (L) fifth distal phalanx



1=head, 2=medial margin of shaft, 3=medial tubercle of base, 4=dorsal medial slope of base, 5=dorsal apex of base, 6=lateral margin of shaft, 7=lateral tubercle of base, 8=dorsal lateral slope of base, 9=palmar lateral extension of head, 10=smooth distal palmar surface of shaft, 11=palmar lateral ridge of shaft, 12=rough proximal palmar concavity of shaft, 13=palmar lateral slope of base, 14=palmar apex of base, 15=palmar medial extension of head, 16=palmar medial ridge of shaft, 17=palmar medial slope of base, 18=lateral articular margin of base, 19=medial articular margin of base, 20=articular facet of base.