REFERENCES

1. Patnaik VVG, Bala S, Singla RK. Anatomy of the bony orbit-some applied aspects. J Anat Soc India 2001; 50(1): 59-67.
2. Forrester JV, Dick AD, McMenamin PG, Lee WR. Anatomy of the eye and orbit. THE EYE Basic sciences in practice 2002: 1-9.
3. Braffman BH, Naidich TP, Chaneles M. Imaging anatomy of the normal orbit. Seminars in ultrasound, CT, and MRI 1997; 18(6): 403-412.
4. Maus M. Update on orbital trauma. Curr Opin Ophthalmol 2001; 12: 329-334.
5. Chang EL, Bernardino CR. Update on orbital trauma. Curr Opin Ophthalmol 2004; 15: 411-415.
6. Saha S, Saha VP, Chattopadhyay S. Orbital and paraorbital tumors-clinicopathological profile and surgical management. Ind Journal of Otolaryngology and HNS 2002; 54(2): 117-122.
7. Siracuse-Lee DE, Kasim M. Orbital decompression: current concepts. Curr Opin Ophthalmol 2002; 13: 310-316.
8. Burnstine MA. Clinical reommendations for repair of orbital facial fractures. Curr Opin Ophthalmol 2003; 14: 236-240.
9. Cruz AAV, Eichenberger GCD. Epidermiology and management of orbital fractures. Curr Opin Ophthalmol 2004; 15: 416-421.
10. Migliori ME. Enucleation versus evisceration. Curr Opin Ophthalmol 2002; 13: 298-302.
11. Kirschner JA, Yanagisawa E, Crelin ES. Surgical anatomy of the ethmoidal arteries. Arch Otolaryngol 1961; 74: 382-386.

12. Rontal E, Rontal M, Guilford FT. Surgical anatomy of the orbit. Ann Otol Rhinol Laryngol 1979; 88: 382-386.

13. McQueen CT, DiRuggiero DC, Campbell JP, Shockley WW. Orbital osteology: A study of the surgical landmarks. Laryngoscope 1995; 105: 783-788.

14. Danko I, Hang RH. An experimental investigation of the safe distance for internal orbital dissection. J Oral Maxillofac Surg 1998; 56: 749-752.

15. Hwang K, Baik SH. Surgical anatomy of the orbit of Korean adults. J craniofac Surg 1999; 10: 129-134.

16. Karakas P, Bozkır MG, Oguz ö. Morphometric measurements from various reference points in the orbit of male Caucasians. Surg Radiol Anat 2002; 24: 358-362.

17. Akdemir G, Tekdemir I, Altın L. Transethmoidal approach to the optic canal: surgical and radiological microanatomy. Surg Neurol 2004; 62: 268-274.

18. Berge JK, Bergman RA. Variations in size and in symmetry of foramina of the human skull. Clin Anat 2001; 14: 406-413.

19. Agthong S, Huanmanop T, Chentanez V. Anatomical variations of the supraorbital, infraorbital and mental foramina related to gender and side. J Oral Maxillofac Surg 2005 ; 63: 800-804.

20. Pickering RB, Bachman DC. The use of forensic anthropology 1997: 84-86.

I 251961212

APPENDICES

APPENDIX A

I. A general knowledge of the orbit

The orbit

The two orbital cavities are situated on either side of the sagittal plane of the skull between the cranium and the skeleton of the face. They are separated from each other by the nasal cavities, ethmoidal and sphenoidal sinuses. Each orbit is intended as a socket for eye-ball and also contained muscles, vessels, nerves, lacrimal apparatus, fascial strata and soft pad.

Parts of the following bones contribute to the walls of the orbit : ethmoid, frontal, palatine, sphenoid, lacrimal, zygomatic and maxilla. The orbit is roughly the shape of a quadrilateral pyramid whose base is the orbital margin or rim and whose apex is at the bar of the bone between the superior orbital fissure and the optic canal. It has a floor, roof, medial wall and lateral wall. The floor tapers off before the apex, therefore the apex of the pyramid is triangular. The orbit is widest approximately 1.5 cm behind the orbital margin. The walls are mostly triangular, except the medial wall, which is oblong. The medial walls are approximately parallel to the mid-sagittal plane, while the lateral walls are oriented at an angle of approximately 45 degree to this plane. The orbital opening is directed forwards, laterally and slightly downwards. Thus nerves and muscles passing from the apex into the orbit pass forward and laterally. The orbit is approximately 35 - 40 mm in height, 40 mm in width and 40 mm in depth. The volume is approximately 30 ml, of which one-fifth is occupied by the eye.

The walls of the orbit (Figure 7):

1. The medial orbital wall

The medial wall is oblong in shape and is the thinnest of the walls. It is about 1/2 the height of the lateral wall since the floor of the orbit inclines upwards to meet it at about 45 degree.

This wall is formed by four bones which united by vertical sutures : the frontal process of the maxilla, the lacrimal bone, the orbital plate of the ethmoid and a small part of the body of the sphenoid. It separates the orbit from the ethmoidal air cells and sphenoidal sinus.

In the anterior part of this wall is the lacrimal fossa for lacrimal sac. It is bound by the anterior and posterior lacrimal crests.

2. The superior orbital wall or roof

The roof is triangular shape and is formed in great part by the triangular orbital plate of the frontal bone and behind this by the lesser wing of the sphenoid.

It is very thin, translucent and fragile except at the lesser wing of sphenoid. It seperates the orbit from the anterior cranial fossa and frontal lobes of the brain. Anteriorly the frontal sinus lies above the orbit.

It presents the fossa for the lacrimal gland and the fovea for the pulley of the superior oblique muscle.

Normally, the anterior and posterior ethmoidal foramina positioned at the junction of roof and medial wall (frontoethmoid suture line). They transmit the anterior and posterior ethmoidal vessels and nerves.

3. The orbital floor

The floor slopes slightly downwards from the medial to the lateral wall. It is formed by three bones : the orbital plate of the maxilla (the largest part) , the orbital surface of the zygomatic (anterolateral part) and the orbital process of the palatine bone (a small area behind the maxilla). Below the floor lies the maxillary sinus.

This wall is traversed by the infraorbital groove, which runs forward from the inferior orbital fissure. Before this groove reaches the orbital margin it becomes the infraorbital canal, which opens as the infraorbital foramen below the orbital margin. It transmits the infraorbital vessels and nerves.

4. The lateral orbital wall

The lateral wall is triangular in shape, the base being anterior. It is the thickest and strongest orbital wall, and separates the orbital contents from the temporal fossa.

This wall is formed by two bones : the orbital surface of the zygomatic bone anteriorly and the orbital surface of the greater wing of sphenoid bone posteriorly.

It presents spini recti lateralis (origin to part of the lateral rectus muscle), the zygomatic groove and foramen (lodge zygomatic vessels and nerve), the lateral orbital tubercle and the lacrimal foramina.

The orbital margin

This is a thickened rim of bone which helps protect the orbital contents. It is made up of three bones : the frontal, zygomatic and maxilla. The orbital margin usually has the form of a spiral, the inferior orbital margin is continuous with the anterior lacrimal crest, while the superior orbital margin is continued down into the posterior lacrimal crest. The lacrimal fossa thus lies in the orbital margin.

The lateral margin is thickest as it is most exposed and therefore prone to trauma. It is also concave forward, thus it does not reach as far anteriorly as the medial margin. The medial margin is sharp and distinct in its lower half because of the anterior lacrimal crest, but is indistinct superiorly.

The fissures and canals between walls of the orbit :

1. The superior orbital (sphenoidal) fissure

The superior orbital fissure is the gap between the lesser and greater wings of the sphenoid closed laterally by the frontal bone. It lies between the roof and lateral wall of the orbit. It is the largest communication between the orbital and cranial cavity.

This fissure is comma shaped, being wider at its medial end and narrowest at its lateral end. It is around 22 mm long and is separated from the optic foramen above by the posterior root of the lesser wing of the sphenoid. The part of the common tendinous ring spans the wide and narrow parts of this fissure. The structures passing this fissure include the lacrimal nerve, frontal nerve, trochlear

nerve, oculomotor nerve, abducent nerve, nasociliary nerve, sympathetic root of ciliary ganglion and superior ophthalmic vein. (Figure 8)

2. The inferior orbital (spheno-maxillary) fissure

The inferior orbital fissure lies between the lateral wall and floor of the orbit. It forms a communication between the orbit and the infratemporal fossa and pterygopalatine fossa.

Its posterior end lies below and lateral to the optic foramen near the superior orbital fissure. It runs forward and laterally for approximately 20 mm. This foramen transmits the infraorbital nerve, zygomatic nerve, branches from the pterygopalatine ganglion and inferior ophthalmic vein.

3. The ethmoidal foramina

The ethmoidal foramina lie between the roof and medial wall of the orbit either in the frontoethmoidal suture. The anterior ethmoidal canal opens in the anterior cranial fossa at the side of the cribiform plate of the ethmoid, and transmits the anterior ethmoidal nerve and artery. The racial variation shows the anterior foramen to lie outside the frontoethmoid suture line. The posterior ethmoidal foramen transmits the posterior ethmoidal nerve and artery. Supplementary foramina are common.

4. The optic canal (foramen)

The optic canal is a bony channel in the sphenoid that passes anteriorly, inferiorly, and laterally from the middle cranial fossa to the apex of the orbit. It is

formed by the two roots of the lesser wing of the sphenoid. It is separated from the medial end of the superior orbital fissure by a bar of bone.

The orbital opening is oval in shape, with the greatest diameter vertical. The cranial opening, on the other hand, is flattened from above down, while in its middle portion the canal is circular on section. The lateral border of the orbital opening is formed by the anterior border of the posterior root of the lesser wing of the sphenoid. The roof of the canal reaches farther forwards than the floor, while posteriorly the floor projects beyond the roof.

This canal transmits the optic nerve with its meningeal coverings, the ophthalmic artery and sympathetic nerve fibers.

5. The lacrimal foramen

The lacrimal or cranio-orbital or spheno-frontal or anastomotic foramen is located in or near the suture between the greater wing of the sphenoid and the frontal bones, near the lateral end of the superior orbital fissure. It connects the middle cranial fossa with the orbit. It is absent or found more than one foramen. It transmits an anastomosis between the anterior branch of the middle meningeal artery and lacrimal artery.

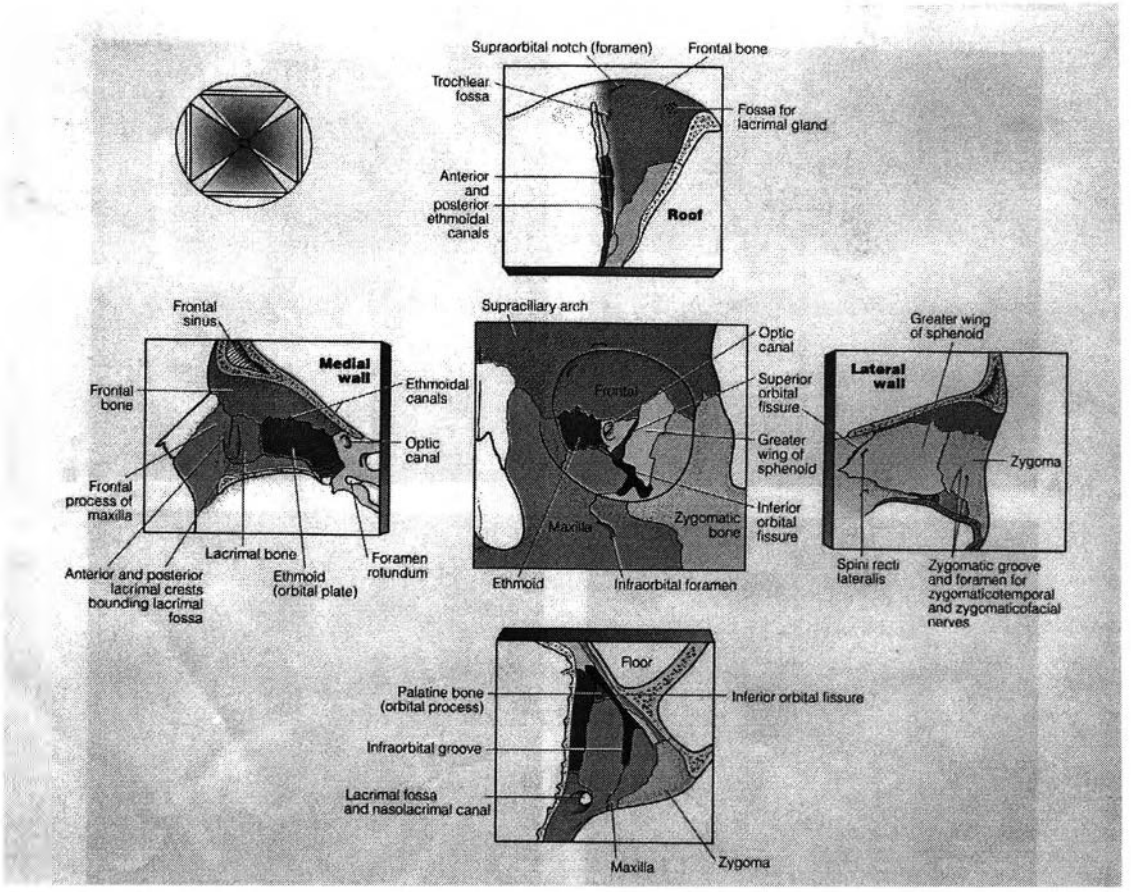

Figure 7. The walls of the orbit (from Forrester JVet al. THE EYE Basic sciences in practice. WB Saunders Press 2002)

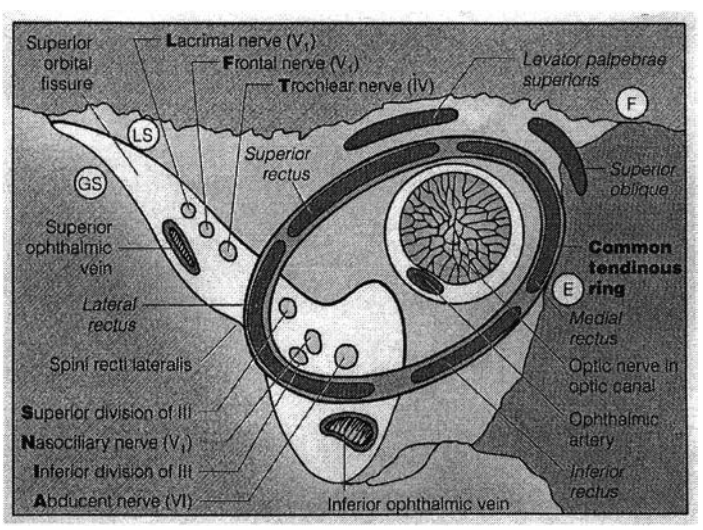

Figure 8. The contents within orbital apex (from Forrester JVet al. THE EYE Basic sciences in practice. WB Saunders Press 2002)

II. The terminology of the diseases and operative procedures of the orbital cavity and paraorbital region

The Graves orbitopathy and orbital decompression

The orbit in Graves disease undergoes expansion in soft tissue contents as a result of the infiltration of orbital fat, extraocular muscles, and the lacrimal gland. Compression of the intraorbital contents leads to disorders of the lid-corneal interface, keratopathy, motility disturbances, exophthalmos and optic neuropathy. The orbital decompression is performed to reverse compressive optic neuropathy and reduce proptosis. Various techniques of bony and fat decompression have evolved to accomplish this goal while minimizing adverse effects.

The optic neuropathy and optic nerve decompression

The optic neuropathy is condition which optic nerve is compressed by many causes such as trauma, mucoceles, pseudotumor cerebri, ischemic optic neuropathy, fibrous dysplasia, endocrine orbitopathy and osteopetrosis. The hallmark is a loss of visual function and a presence of an afferent pupillary defect. The optic nerve decompression is performed to reverse a compression of the optic nerve in a tight bony canal.

The orbital facial fractures

The orbital fractures are a common result of facial injury. Recognized sequelae of orbital facial fractures include enophthalmos, diplopia from

extraocular muscle dysfunction (entrapment, ischemia, hemorrhage, or nerve injury), infraorbital nerve anesthesia, disfiguring facial contours, difficulty chewing and tearing from obstruction of the nasolacrimal duct. The indications and timing for fracture repair are debated.

The enucleation with or without orbital prosthesis

The enucleation is removal of only the globe. A silicone intraorbital prosthesis can be used to improve cosmesis. A prosthesis is contraindicated in the presence of orbital infection or neoplasia.

The exenteration with or without orbital prosthesis

The exenteration is the removal of all of the orbital contents and the globe. Usually performed for orbital neoplasia or infection. An orbital prosthesis can be implanted if there is no residual neoplasia or infection.

The evisceration and intraocular prosthesis

The removal of the intraocular contents leaving the corneo-scleral shell that is then filled with a silicone prosthesis. This prosthesis is contraindicated in the presence of intraocular infection, concurrent ocular diseases such as corneal ulceration or dry eye, and ocular neoplasia. It is more cosmetic than an enucleation.

APPENDIX B

Student's *t* test for side difference (gender independence) (SPSS Version 13)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	ALC-PLC (Left) - ALC-PLC (Right)	-.28420	.85877	.1214	-.52826	-.04014	-2.340	49	.023
Pair 2	ALC-AEF (Left) - ALC-AEF (Right)	-.74780	1.66002	.2348	-1.220	-.27603	-3.185	49	.003
Pair 3	ALC-PEF (Left) - ALC-PEF (Right)	-.75780	1.97044	.2787	-1.318	-.19781	-2.719	49	.009
Pair 4	ALC-OC (Left) - ALC-OC (Right)	-.16960	1.68437	.2382	-.64829	30909	-.712	49	.480
Pair 5	AEF-OC (Left) - AEF-OC (Right)	.36360	1.81850	.2572	-.15321	.88041	1.414	49	.164
Pair 6	AEF-PEF (Left) - AEF-PEF (Right)	-.06700	1.99021	.2815	-.63261	.49861	-.238	49	.813
Pair 7	PEF-OC (Left) - PEF-OC (Right)	.00880	1.57290	.2224	-.43821	.45581	.040	49	.969

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lowe r	Upper			
Pair 1	SF-CMSOF (Left) - SF-CMSOF (Right)	-.33460	2.20543	.31190	-.961	.29218	-1.073	49	.289
Pair 2	SF-OC (Left) - SF-OC (Right)	.38160	1.90481	.26938	-.160	.92294	1.417	49	.163
Pair 3	SF-LF (Left) - SF-LF (Right)	-2.149	2.82830	.89439	-4.17	-.12576	-2.403	9	.040

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	IF-CMIOF (Left) - IF-CMIOF (Right)	.4178	1.96370	.27771	-.14028	.97588	1.504	49	.139
Pair 2	IF-OC (Left) - IF-OC (Right)	-.674	2.41074	.34093	-1.359	.01093	-1.978	49	.054
Pair 3	IF-PMCION (Left) - IF-PMCION (Right)	.1546	3.54612	.50150	-.85320	1.16240	.308	49	.759

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	FZ-CMSOF (Left) - FZ-CMSOF (Right)	-.3966	2.02995	.2871	-.974	18031	-1.382	49	.173
Pair 2	FZ-CMIOF (Left) - FZ-CMIOF (Right)	-1.433	2.25408	.3188	-2.07	-.79220	-4.495	49	.000
Pair 3	FZ-OC (Left) - FZ-OC (Right)	.63860	1.93717	.2740	.0881	1.18914	2.331	49	.024
Pair 4	FZ-LF (Left) - FZ-LF (Right)	-.5610	2.84335	.8991	-2.60	1.47301	-.624	9	.548

Student's *t* test for side difference (in male) (SPSS Version 13)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	ALC-PLC (Left) - ALC-PLC (Right)	-.30680	.82194	.16439	-.64608	.03248	-1.866	24	.074
Pair 2	ALC-AEF (Left) - ALC-AEF (Right)	-.66080	1.70101	.34020	-1.363	.04134	-1.942	24	.064
Pair 3	ALC-PEF (Left) - ALC-PEF (Right)	-.61680	2.09876	.41975	-1.483	.24952	-1.469	24	.155
Pair 4	ALC-OC (Left) - ALC-OC (Right)	-.50040	1.62033	.32407	-1.169	.16844	-1.544	24	.136
Pair 5	AEF-OC (Left) - AEF-OC (Right)	-.09200	1.92111	.38422	-.88500	.70100	-.239	24	.813
Pair 6	AEF-PEF (Left) - AEF-PEF (Right)	-.05360	1.93316	.38663	-.85157	.74437	-.139	24	.891
Pair 7	PEF-OC (Left) - PEF-OC (Right)	-.02680	1.44769	.28954	-.62438	.57078	-.093	24	.927

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lowe r	Upper			
Pair 1	SF-CMSOF (Left) - SF-CMSOF (Right)	-.8336	2.48474	.49695	-1.86	.19205	-1.677	24	.106
Pair 2	SF-OC (Left) - SF-OC (Right)	.24000	2.25875	.45175	-.692	1.17236	.531	24	.600
Pair 3	SF-LF (Left) - SF-LF (Right)	-3.308	2.52428	1.1289	-6.44	-.17370	-2.930	4	.043

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	IF-CMIOF (Left) - IF-CMIOF (Right)	.32640	1.42825	.28565	-.2632	.91595	1.143	24	.264
Pair 2	IF-OC (Left) - IF-OC (Right)	-.47880	1.78440	.35688	-1.215	.25776	-1.34	24	.192
Pair 3	IF-PMCION (Left) - IF-PMCION (Right)	1.03520	2.36623	.47325	.05847	2.01193	2.187	24	.039

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lowe r	Upper			
Pair 1	FZ-CMSOF (Left) - FZ-CMSOF (Right)	-.45640	2.34005	.4680	-1.42	.50952	-.975	24	.339
Pair 2	FZ-CMIOF (Left) - FZ-CMIOF (Right)	-.62280	2.64343	.5287	-1.71	.46835	-1.178	24	.250
Pair 3	FZ-OC (Left) - FZ-OC (Right)	1.03040	1.81816	.3636	.2799	1.78090	2.834	24	.009
Pair 4	FZ-LF (Left) - FZ-LF (Right)	-2.40800	2.89979	1.297	-6.01	1.19256	-1.857	4	.137

Student's *t* test for side difference (in female) (SPSS Version 13)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	ALC-PLC (Left) - ALC-PLC (Right)	-.26160	.91053	.18211	-.6374	.11425	-1.437	24	.164
Pair 2	ALC-AEF (Left) - ALC-AEF (Right)	-.83480	1.64830	.32966	-1.515	-.15441	-2.532	24	.018
Pair 3	ALC-PEF (Left) - ALC-PEF (Right)	-.89880	1.86570	.37314	-1.669	-.12868	-2.409	24	.024
Pair 4	ALC-OC (Left) - ALC-OC (Right)	.16120	1.71434	.34287	-.5464	.86885	.470	24	.642
Pair 5	AEF-OC (Left) - AEF-OC (Right)	.81920	1.62128	.32426	.14997	1.48843	2.526	24	.019
Pair 6	AEF-PEF (Left) - AEF-PEF (Right)	-.08040	2.08554	.41711	-.9413	.78047	-.193	24	.849
Pair 7	PEF-OC (Left) - PEF-OC (Right)	.04440	1.71833	.34367	-.6649	.75369	.129	24	.898

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SF-CMSOF (Left) - SF-CMSOF (Right)	.16440	1.79940	.3599	-.5784	.90716	.457	24	.652
Pair 2	SF-OC (Left) - SF-OC (Right)	.52320	1.50467	.3009	-.0979	1.14430	1.739	24	.095
Pair 3	SF-LF (Left) - SF-LF (Right)	-.9900	2.87544	1.286	-4.560	2.58033	-.770	4	.484

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	IF-CMIOF (Left) - IF-CMIOF (Right)	.50920	2.41155	.48231	-.4862	1.50464	1.056	24	.302
Pair 2	IF-OC (Left) - IF-OC (Right)	-.8696	2.93290	.58658	-2.080	.34104	-1.482	24	.151
Pair 3	IF-PMCION (Left) - IF-PMCION (Right)	-.7260	4.29643	.85929	-2.499	1.04748	-.845	24	.407

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	FZ-CMSOF (Left) - FZ-CMSOF (Right)	-.3368	1.71168	.34234	-1.043	.36975	-.984	24	.335
Pair 2	FZ-CMIOF (Left) - FZ-CMIOF (Right)	-2.243	1.42086	.28417	-2.829	-1.65630	-7.892	24	.000
Pair 3	FZ-OC (Left) - FZ-OC (Right)	.24680	2.00900	.40180	-.58247	1.07607	.614	24	.545
Pair 4	FZ-LF (Left) - FZ-LF (Right)	1.286	1.11943	.50063	-.10396	2.67596	2.569	4	.062

Student's *t* test for gender difference in left - side orbit (SPSS Ver. 13)

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
ALC-PLC (Left)	Equal variances assumed	2.001	.164	1.505	48	.139	.48080	.31944	-.16148	1.12308
	Equal variances not assumed			1.505	43.880	.139	.48080	.31944	-.16304	1.12464
ALC-AEF (Left)	Equal variances assumed	.181	.673	1.424	48	.161	1.02320	.71855	-.42155	2.46795
	Equal variances not assumed			1.424	47.551	.161	1.02320	.71855	-.42190	2.46830
ALC-PEF (Left)	Equal variances assumed	1.647	.206	-.186	48	.854	-.12440	.67029	-1.472	1.22332
	Equal variances not assumed			-.186	46.632	.854	-.12440	.67029	-1.473	1.22434
ALC-OC (Left)	Equal variances assumed	5.431	.024	-.889	48	.379	-.51840	.58322	-1.691	.65423
	Equal variances not assumed			-.889	38.703	.380	-.51840	.58322	-1.698	.66155
AEF-OC (Left)	Equal variances assumed	.174	.679	-1.48	48	.144	-.83000	.55950	-1.955	.29495
	Equal variances not assumed			-1.48	47.870	.145	-.83000	.55950	-1.955	.29503
AEF-PEF (Left)	Equal variances assumed	.728	.398	-1.77	48	.083	-.98400	.55598	-2.102	.13387
	Equal variances not assumed			-1.77	42.757	.084	-.98400	.55598	-2.105	.13742
PEF-OC (Left)	Equal variances assumed	1.964	.168	.990	48	.327	.46640	.47094	-.48049	1.41329
	Equal variances not assumed			.990	41.400	.328	.46640	.47094	-.48440	1.41720

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SF-CMSOF (Left)	Equal variances assumed	2.369	.130	.649	48	.520	.42760	.65909	-.8976	1.75279
	Equal variances not assumed			.649	42.25	.520	.42760	.65909	-.9023	1.75747
SF-OC (Left)	Equal variances assumed	1.280	.264	1.63	48	.111	1.09360	.67288	-.2593	2.44652
	Equal variances not assumed			1.63	43.15	.111	1.09360	.67288	-.2633	2.45046
SF-LF (Left)	Equal variances assumed	1.484	.239	-.445	18	.661	-.73538	1.65134	-4.205	2.73396
	Equal variances not assumed			-.522	17.81	.608	-.73538	1.40889	-3.698	2.22680

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
IF-CMIOF (Left)	Equal variances assumed	002	962	1.009	48	.318	.59280	.58769	-.5888	1.77442
	Equal variances not assumed			1.009	47.950	.318	.59280	.58769	-.5889	1.77445
IF-OC (Left)	Equal variances assumed	1.321	.256	1.562	48	.125	1.19840	.76716	-.3441	2.74089
	Equal variances not assumed			1.562	46.225	.125	1.19840	.76716	-.3456	2.74242
IF-PMCION (Left)	Equal variances assumed	.071	.791	-.136	48	.892	-.13120	.96448	-2.070	1.80802
	Equal variances not assumed			-.136	47.939	.892	-.13120	.96448	-2.070	1.80808

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
FZ-CMSOF (Left)	Equal variances assumed	.024	.879	.729	48	.470	.51800	.71077	-.9111	1.94710
	Equal variances not assumed			.729	47.325	.470	.51800	.71077	-.9116	1.94763
FZ-CMIOF (Left)	Equal variances assumed	1.441	.236	2.226	48	.031	1.39480	.62672	.13470	2.65490
	Equal variances not assumed			2.226	46.948	.031	1.39480	.62672	.13397	2.65563
FZ-OC (Left)	Equal variances assumed	5.058	.029	1.986	48	.053	1.21240	.61046	-.0150	2.43981
	Equal variances not assumed			1.986	37.992	.054	1.21240	.61046	-.0234	2.44821
FZ-LF (Left)	Equal variances assumed	2.278	.149	-1.046	18	.309	-1.77341	1.69510	-5.335	1.78786
	Equal variances not assumed			-1.234	17.899	.233	-1.77341	1.43696	-4.794	1.24675

Student's *t* test for gender difference in right - side orbit (SPSS Version 13)

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
ALC-PLC (Right)	Equal variances assumed	.214	.646	2.308	48	.025	.52600	.22787	.06783	.98417
	Equal variances not assumed			2.308	47.98	.025	.52600	.22787	.06782	.98418
ALC-AEF (Right)	Equal variances assumed	2.835	.099	1.122	48	.267	.84920	.75657	-.6720	2.3704
	Equal variances not assumed			1.122	45.45	.268	.84920	.75657	-.6742	2.3726
ALC-PEF (Right)	Equal variances assumed	1.536	.221	-.557	48	.580	-.40640	.72941	-1.873	1.0602
	Equal variances not assumed			-.557	44.37	.580	-.40640	.72941	-1.876	1.0633
ALC-OC (Right)	Equal variances assumed	4.999	.030	.194	48	.847	.14320	.73885	-1.342	1.6288
	Equal variances not assumed			.194	42.29	.847	.14320	.73885	-1.348	1.6340
AEF-OC (Right)	Equal variances assumed	.736	.395	.146	48	.884	.08120	.55432	-1.033	1.1957
	Equal variances not assumed			.146	46.18	.884	.08120	.55432	-1.034	1.1969
AEF-PEF (Right)	Equal variances assumed	1.070	.306	-1.8	48	.070	-1.01080	.54641	-2.109	.08784
	Equal variances not assumed			-1.8	46.26	.071	-1.01080	.54641	-2.111	.08891
PEF-OC (Right)	Equal variances assumed	.040	.843	1.225	48	.227	.53760	.43890	-.3449	1.4201
	Equal variances not assumed			1.225	47.67	.227	.53760	.43890	-.3450	1.4202

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SF-CMSOF (Right)	Equal variances assumed	.002	.967	2.172	48	.035	1.42560	.65645	.10572	2.7455
	Equal variances not assumed			2.172	47.904	.035	1.42560	.65645	.10565	2.7456
SF-OC (Right)	Equal variances assumed	.134	.716	2.257	48	.029	1.37680	.61001	.15030	2.6033
	Equal variances not assumed			2.257	46.866	.029	1.37680	.61001	.14953	2.6041
SF-LF (Right)	Equal variances assumed	.178	.679	.930	15	.367	1.50986	1.62334	-1.950	4.9699
	Equal variances not assumed			.954	14.144	.356	1.50986	1.58223	-1.880	4.9002

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
IF-CMIOF (Right)	Equal variances assumed	.743	.393	1.509	48	.138	.77560	.51396	-.2578	1.80898
	Equal variances not assumed			1.509	47.302	.138	.77560	.51396	-.2582	1.80938
IF-OC (Right)	Equal variances assumed	.560	.458	1.019	48	.313	.80760	.79252	-.7859	2.40108
	Equal variances not assumed			1.019	47.987	.313	.80760	.79252	-.7859	2.40109
IF-PMCION (Right)	Equal variances assumed	.492	.487	-1.668	48	.102	-1.89240	1.13473	-4.174	.38914
	Equal variances not assumed			-1.668	46.520	.102	-1.89240	1.13473	-4.176	.39101

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
FZ-CMSOF (Right)	Equal variances assumed	.093	.762	.860	48	.394	.63760	.74178	-.8538	2.12904
	Equal variances not assumed			.860	47.961	.394	.63760	.74178	-.8539	2.12908
FZ-CMIOF (Right)	Equal variances assumed	.014	.907	-.37	48	.710	-.22520	.60262	-1.437	.98644
	Equal variances not assumed			-.37	47.995	.710	-.22520	.60262	-1.437	.98645
FZ-OC (Right)	Equal variances assumed	1.52	.223	.600	48	.551	.42880	.71424	-1.007	1.86488
	Equal variances not assumed			.600	46.997	.551	.42880	.71424	-1.008	1.86568
FZ-LF (Right)	Equal variances assumed	.990	.336	1.1	15	.307	1.87400	1.77333	-1.906	5.65377
	Equal variances not assumed			1.2	14.183	.259	1.87400	1.59399	-1.541	5.28864

BIOGRAPHY

Mr. Thanasil Huanmanop was born on December 24, 1977 in Bangkok, Thailand. He received his Bachelor degree of Medicine (M.D., second class honours) in 2000 from the Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand. He has enrolled in graduate programme for Master degree of Medical Science at Chulalongkorn University since 2004.