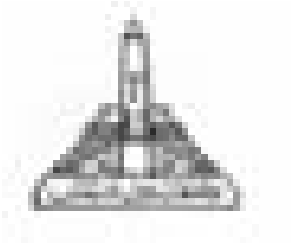

Application of Laser Interference Technique to Investigate Hematological Disorders

THESIS

Submitted to Faculty of Science, Ain Shams University in partial fulfillment for degree of M.Sc. in Physics

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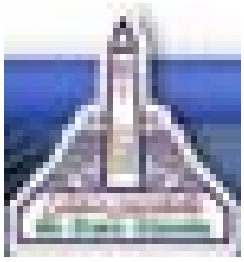

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References

Ailing Y., Wendong L., Guang Y., Dong J., and Zhang J., (2006): "Measuring Liquids refractive indices by capillary tube interferometer", J.opt. A: pure Appl. Opt., 2:300-310.

Aldrich T.K., Moosikasuwan M., Shah S.D., Deshpande K.S., (2002): "Length-normalized pulse photoplethysmography: a noninvasive method to measure blood hemoglobin" Ann Biomed Eng 30:1291-1298.

Alberts., and Bruce., (2005): "Leukocyte functions and percentage breakdown".Molecular Biology of the Cell. NCBI Bookshelf. Retrieved on 14-04-2007.

Anemia disease. Retrieved from http://www.measuredhs.com/topics /anemia /start.cfm) on 16/09/09)

Anemia. Retrieved from http://www.innvista.com/health/ailments/anemias/anemiaty.htm

American Association for Clinical Chemistry; (2005)

Chernecky, Cynthia C., and Berger, Barbara J., (2001): "Laboratory Tests and Diagnostic Procedures" 3rd ed. Philadelphia, PA: W. B. Saunders Company.

Dacie and Lewis., (2006): "Textbook of practical haematology"ISBN-10:0-443-06660-4

DeMaeyer E., Adiels-Yagman M., (1985): "The prevalence of anemia in the world". World Health Statistics; 38:302-316.

Deyo D.J., Esenaliev R.O., Hartrumpf O., Motamedi M., Prough D.S., (2001): "Continuous noninvasive optoacoustic monitoring of hemoglobin concentration". Anesthesiol Analgesia; 92:S139.

Diaconu V., Faubert J., (2000): "On-line and real-time spectroreflectometry measurement of oxygenation in a patient's eye". United States Patent: 6149589.

El-Ghandoor H., Abd El-Ghafar E.A. and Hassan R., (1999): "Refractive index profiling of a GRIN Optical Fiber using a Modulated Speckled Sheet of Light", Opt. Laser Technol, 31:481-488.

El-Ghandoor H., Nasser I., Abd El-Rahman M.A., and Hassan R., (2000): "Theoretical model for the transverse interference pattern of GRIN optical fiber using a laser sheet of light", Opt. Laser Technol, 32:281-286.

El–Ghandoor H., Nasser I., Abd El-Rahman M.A., and Shukri A.Al., (2001): "Transverse Interference Pattern for the Examination of Spliced Optical Fibers", International Symposium on Optical Science and Technology, San Diego, CA, USA, 29July – 3 August, SPIE, 4436-29.

El–Ghandoor H., Hegazy E., Nasser I., and Behery G.M., (2003): "Measuring the refractive Index of Crude Oil using a capillary tube Interferometer", Opt. Laser Technol, 35:361-367.

Ernsting K., Suner S., Jay G.D., (2001): "Use of digital imaging of conjunctiva to predict hemoglobin concentration". Acad Emerg Med 8:528-529.

Esenaliev R.O., Petrov Y.Y., Hartrumpf O., Deyo D.J., Prough D.S., (2004): "Continuous, noninvasive monitoring of total hemoglobin concentration by an optoacoustic technique". Appl Opt 43:3401-3407.

Faubert J., Gagnon M., Diaconu V., (1999): "The OSOME system: a new real-time non-invasive technique for measuring oxygenation and hemoglobin in the human eye". Invest Ophth Vis Sci; 40:S977-S.

Fine I., Geva D., Amir O., Monashkin E., (2004): "Clinical Evaluation of non-invasive hemoglobin testing device". American Society of Anesthesiologists Annu Meeting Vol. A-597. New Orleans, LA.

Genzel-Boroviczeny O., Harris A.G., Fletcher G.D., Christ F., (2000): "Noninvasive determination of hemoglobin in neonates with orthogonal polarization spectral (OPS) imaging". Pediatr Res; 47:332A-A.

Goodnough L.T., Nissenson A.R., (2004): "Anemia and its clinical consequences in patients with chronic diseases". Am J Med; 116:1-2.

Golder M.,Chen S., (2000): " Potential risk of cross-infection during peripheral-venous access by contaminated tourniquets". Lancet 355:44.

Hemoglobinmeter. Retrieved from http://www.hemoglobinometer.co.uk/ on 21 September 2007

Hemoglobinometer–Hemacue. Retrieved from http://www.lewest.co.uk static/ HEMOGLOBINOMETER-HEMACUE-M1691.htm on 21 September 2007

Hovinga K.I., Koopmans M., de Heer E., Bruijn J., Bajema I., (2007): "Change in blood group in systemic lupus erythematosus", Lancet 369 (9557): 186-7.

Hsia, Connie C.W., (1998): "Respiratory Function of Hemoglobin". New England Journal of Medicine. 338:239-247.

Hung O.L., Kwon N.S., Cole A.E., Dacpano G.R., Wu T., Chiang W.K., Goldfrank L.R., (2000): "Evaluation of the physician's ability to recognize the presence or absence of anemia, fever, and jaundice". Acad Emer Med; 7:146-156.

Iftimia N.V., Hammer D.X., Bigelow C.E., Rosen D.I., Ustun T., Ferrante A.A., (2006): "Toward noninvasive measurement of blood hematocrit using spectral domain low coherence interferometry and retinal tracking" Opt Exp 14:3377-3388.

Jeon K.J., Kim S.J., Park K.K., Kim J.W., Yoon G., (2002): "Noninvasive total hemoglobin measurement". J Biomed Opt; 7:45-50.

John W.M., Gregory D.J., Selim S., Gregory C., (2008): "Noninvasive Optical, Electrical, and Acoustic Methods of Total Hemoglobin Determination" Clinical Chemistry; 54:264-272.

Kanashima H., Yamane T., Takubo T., Kamitani T., Hino M., (2005): "Evaluation of noninvasive hemoglobin monitoring for hematological disorders". J Clin Lab Anal; 19:1-5.

Kee, Joyce LeFever., (2001): "Handbook of Laboratory and Diagnostic Tests". 4th ed. Upper Saddle River, NJ: Prentice Hall.

Kost G.J., Tran N.K., Tuntideelert M., Kulrattanamaneeporn S., Peungposop N. Katrina., (2006): " the tsunami, and point-of-care testing: optimizing rapid response diagnosis in disasters". Am J Clin Pathol; 126:513-520.

Khalil O.S., Yeh S., Lowery M.G., Wu X., Hanna C.F., Kantor S., (2003): "Temperature modulation of the visible and near infrared absorption and scattering coefficients of human skin". J Biomed Opt 8:191-205.

Lawlor, Robert., (1991): "Voices of the First Day: Awakening in the Aboriginal dreamtime", Rochester, Vermont: Inner Traditions International.

Landsteiner K., Wiener A.S., (1940): "An agglutinable factor in human blood recognized by immune sera for rhesus blood", Proc. Soc. Exp. Biol. Med.43:223-224.

Lardi A. M et al., (1998): "Evaluation of the HemoCue for measuring intra-operative hemoglobin Concentrations": a comparison with the Coulter Max-M. Anaesthesia Vol. 53 Issue4: 349-352.

Leukocytosis. Retrieved from http://en.wikipedia.org/wiki/ on 4 January 2011 at 20:24

Leukopenia. Retrieved from http://en.wikipedia.org/wiki/ on 15 January 2011 at 16:28.

Leitgeb R., Hitzenberger C.K., Fercher A.F., (2003): "Performance of Fourier domain vs. time domain optical coherence tomography". Opt Exp; 11:889-894.

Liau C.Y., Chang T.M., Pan J.P., Chen W.L., Mao S.J.T., (2009): "Purification of Human plasma using Hemoglobin-Affinity Column" Chromatography B790 (1-2).

Marhic and Stien., (1975), Appl. Phys. Lett. 35:1678-1682.

Martini, Frederic., (2006): "Human Anatomy". San Francisco, California: Pearson Education, Inc, 5th ed. Page 529.

McMurdy J.W., Jay G.D., Suner S., Trespalacios F.M., Crawford **G.P., (2000)**: "Diffuse reflectance spectra of the palpebral conjunctiva and its utility as a noninvasive indicator of total hemoglobin". J Biomed Opt 11:014019.

Nadeau R.G., Groner W., (2001): "The role of a new noninvasive imaging technology in the diagnosis of anemia" J Nutr; 131:1610S-1614S.

Nissenson A.R., Goodnough L.T., Dubois R.W., (2003): "Anemia: not just an innocent bystander". Arch Intern Med; 163:1400-1404.

Pereira A.A., Sarnak M.J., (2003): "Anemia as a risk factor for cardiovascular disease". Kidney Int; 64:S32-S39. National Anemia Action Council. The prevalence and impact of anemia: a systematic review of the published literature http://www.anemia.org/about_anemia/systematic_review. jsp (Accessed 2005).

Petrova I.Y., Esenaliev R.O., Petrov Y.Y., Brecht H.E., Svensen C.H., Olsson J., (2005): Optoacoustic monitoring of blood hemoglobin concentration: a pilot clinical study". Opt Lett 30:1677-1679.

Powell J.S., Gresens C.J., Miller D., Dummer W., Holland P., (2005): "Non-invasive measurement of hematocrit to screen potential blood donors". Transfusion 45:157A-A.

Quest Diagnostics, 2004 Retrieved from www.questdiagnostics.com.

Rendell M., Anderson E., Schlueter W., Mailliard J., Honigs D., Rosenthal R., (2003): "Determination of hemoglobin levels in the finger using near infrared spectroscopy". Clin Lab Haematol; 25:93-97.

Rice M.J., Sweat J., Rioux J.M., Williams W.T., Routt W., (2002): "Non-invasive measurement of blood components using retinal imaging". United States Patent 6477394.

Rodak., (2007): "Textbook of Biomedical Science", BMED19012 - Chapter 18 - Page 209.

Saigo K., Imoto S., Hashimoto M., Mito H., Moriya J., Chinzei T., (2004): "Noninvasive monitoring of hemoglobin: the effects of WBC counts on measurement"Am J Clin Pathol; 121:51-55.

Secomski W., Nowicki A., Guidi F., Tortoli P., Lewin P.A., (2003): "Noninvasive in vivo measurements of hematocrit".J Ultrasound Med 22:375-384.

Shapiro N.I., Stumpf M., Chiota N., Resciniti M., Nicolet J., Ufberg J., (2004): "A standardized conjunctiva pallor tool predicts anemia" Acad Emerg Med 11:478.

Shvartsman L.D., Fine I., (2003): "Optical transmission of blood: effect of erythrocyte aggregation". IEEE Trans Biomed Eng; 50:1026-1033.

Soller B.R., Cabrera M., Smith S.M., Sutton J.P., (2002): "Smart medical systems with application to nutrition and fitness in space". Nutrition 18:930-936.

Soller B.R., Zhang S., Kaur S., Heard S.O., Gaca C., Rohrer M.J., (1999): "Application of near infrared spectroscopy for the noninvasive measurement of hematocrit on surgical patients", Crit Care Med 27:A144-A.

Sutton C.D.,white S.A.,Edwards R., (1999): "Aprospective controlled trial of the efficacy of isopropyl alcohol wipes before venesection in surgical patients". Annals of Royal College of Surgeons 81:183-186.

Thrombocytopenia. Retrieved from http://en.wikipedia.org/wiki/ on 20 Feb. 2011 at 04:56.

Toto R.D., (2003): "Anemia of chronic disease: past, present, and future". Kidney Int; 64:S20-SS3.

Ulijaszek S.J., (1994): "Between-population variation in preadolescent growth". Eur J Clin Nutr; 48:S5-S14.

Van W., Keegels G., Cornelis G.,Ancona C., Mangelschots E.B.,& Van Balen H., (1983): "Hemoglobin measurement: the reliability of some simple techniques for use in a primary health care setting", the World Health Organization, 61(6): 957-965.

Verhoef H., West C.E., Kraaijenhagen R., Nzyuko S.M., King R., Mbandi., et al., (2002): "Malarial anemia leads to adequately increased erythropoiesis in asymptomatic Kenyan children". Blood; 100:3489-3494.

Winkelman J.W., (2000): "Noninvasive blood bell measurements by imaging of the microcirculation". Am J Clin Pathol 113:479-483.

Winkelman J.W., (1991): "Apparatus and method for in vivo analysis of red and white blood cells". United States Patent 4998533.

World Health Organization., (1968): "Nutrional anemias": report of the WHO Scientific Group. WHO Technical Report Series: 415.

Wu X.M. Yeh S., Jeng T.W., Khalil O.S., (2000):"Noninvasive determination of hemoglobin and hematocrit using a temperature-controlled localized reflectance tissue photometer". Anal Biochem 287:284-293.

Xiangqun Xu, Lingfeng Yu, Zhongping Chen., (2008):"Effect of Erythrocyte Aggregation on Hematocrit Measurement Using Spectral-Domain Optical Coherence Tomography". IEEE trans on biomedical engineering; 55:2753-2758.

Yamakoshi K.I., Shimazu H., Togawa T., Fukuoka M., Ito H., (1980): "Non-invasive measurement of hematocrit by electrical admittance plethysmography technique". IEEE Trans Biomed Eng; 27:156-161.

Yamakoshi K., Tanaka S., Shimazu H., (1994): "Electrical admittance cuff for noninvasive and simultaneous measurement of hematocrit, arterial-pressure and elasticity using volume-oscillometric method". Med Biol Eng Comput; 32:S99-S107.

Zhang S.B., Soller B.R., Kaur S., Perras K., Vander Salm T.J., (2000): "Investigation of noninvasive in vivo blood hematocrit measurement using NIR reflectance spectroscopy and partial least-squares regression". Appl Spectrosc; 54:294-299.

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