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Recapturing Science in Clinical Photography

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The world of medical imaging exploded into prominence in the late 20th Century. Magnetic Resonance, 3-D CAT scans, and functional PET scans all made it unnecessary to actually see the body. Clinical photography lingered in the analog realm in the 1980's while novel computer-based technologies grabbed scientific and public attention. As these changes occurred, simple patient and disease-related photography slipped in recognition to the level of 'common' and/or 'old-fashioned.' With little remaining momentum for standardization or quantification, medical photographs became devalued, often being characterized as 'mere visual anecdotes'. By the time digital photographic density started to match emulsion's accuracy in the 1990's, few in medicine were using clinical images as quantifiable sources for scientific data, and countless clinicians who had access to 'point-and-shoot' technology were satisfied by medical 'snapshots' which flooded the field.

After the publication of John Paul Vetter's major text of Biomedical Photography in 1992 (Vetter 1992), far too little attention was directed to the production of standardized clinical photographs, and far too little teaching of standards for anatomic capture has taken place. Even in the world of Plastic Surgery, where it is generally acknowledged that anatomically accurate images be produced for every surgical case, photographs are still captured anecdotally. Perhaps more important, there is little published dialog on image quality, no agreement about standards of technique, and no practical or investigative guide available for the scientific analysis of clinical images that are produced.

In this new millennium, image analysis software is commonly available for useful investigation of visual information obtained in the visible light spectrum. Although no one would ethically advocate digital alteration of data included in scientific images, non-destructive digital analysis is a valid and underutilized tool for investigation. With urgently needed guidance from biomedical imaging professionals, I would predict that photography will resurface in the world of medicine, but in a more scientifically valid format to answer complex anatomic questions. If standards are articulated for the capture of body images, if rotational techniques are employed (analogous to CAT-scan and MRI methods), and if non-destructive digital analysis is consistently applied, then valuable new data could be reliably and repeatedly obtained.

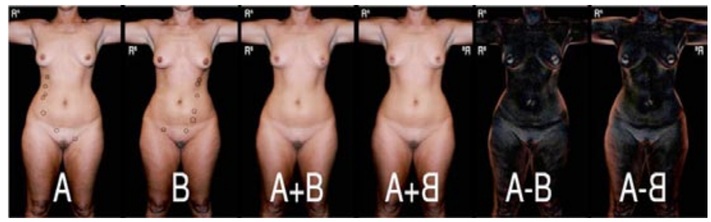

Figure 1. *Mirror Phenomenon in Monozygotic Twins. This is the first digitally analyzed and published case of anatomic mirroring of torso anatomy in a set of monozygotic twins. Each view was taken at end-expiration with bilaterally symmetrical lighting. Additionally, please note the chains of intradermal nevi (denoted with circles and squares) with nearly identical, but mirror-opposite configurations. The following pertains only to the torso, since limb positions vary with motion. Left to right: [A] Twin A in the native state; [B] Twin B in the native state; [A + B] the digital fusion of the native states of Twin A and Twin B, showing significant anatomic alignment; [A + flipped B] the digital fusion of the native state of Twin A and the horizontally flipped version of Twin B, showing even more complete anatomic alignment; [A – B] the digital subtraction of the native state of Twin B from the native state of Twin A confirming incomplete alignment (especially visible in the nipple-areolar complexes) and showing symmetrical 'ghosting' (especially visible along the hips and flanks) consistent with anatomic mirroring; and [A – flipped B] the digital subtraction of the horizontally flipped version of Twin B from the native state of Twin A, confirming more complete anatomic alignment of the torso, but showing a less-symmetrical ghosting pattern. The non-mirrored configuration in the final flipped version is consistent with mirroring in the native state. This entire sequence of findings proves the presence of concordant but mirrored body shape within the native anatomy of this monozygotic twin pair. The findings of mirroring or non-mirroring of body form are in agreement with the orientation of secondary skin findings (similarly mirrored or non-mirrored) in each monozygotic twin pair studied to date. The frequency of this phenomenon (which appears to differ with gender) and its genetic etiology have yet to be determined.*

I have used digital analysis of standardized photographs to demonstrate a level of concordance in facial anatomy of monozygotic twins that was never previously recognized (Teplica and Keith 1996). In the last few years alone, commonly available image analysis software was used to define and characterize the twin Mirror Phenomenon which previously had only been rumored to exist without any scientific validation (Teplica and Peekna 2005). In addition, these techniques have been used to begin to answer questions about human embryology and early development (Teplica et al 2007). Finally, the same techniques have preliminarily confirmed mirroring of body form in twin torsos (Figure 1), providing insight on the genetic predetermination of body shape, and explaining the futility of diet and exercise to do anything but temporarily change one's size (Teplica 2009). In each case, standardized visible-spectrum photographs served as the vehicle for data acquisition and analysis.

Similarly, the progression of almost any disease or anatomic change could be accurately and repeatedly captured and measured. As an example from the field of Plastic Surgery, if strict imaging standards could also be applied to the often woefully vernacular "before and after" sequences, then accurate assessment of results could be made (Figure 2) and the quantification of surgical outcomes might soon become routine (Figure 3). It is clear that the possible avenues of photographic investigation are numerous and that their exploration is long overdue.

I believe a rich and scientifically valuable future is possible for biomedical images that are quantifiable. Highly standardized photographs harvested with a rotational technique and studied with image-analysis software actually become functional, and can provide a trove of valid data to answer long-held questions about human anatomy, its origins, or its change over time. It is clear that biomedical imaging professionals who embrace both digital technology and standardization must guide the clinical world toward meaningful data acquisition from the visible light spectrum.

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References

Teplica, D. "Iconography in Twins: A Modern Photographic Perspective", presented as the Keynote Address to the 1st World Congress of Twin Pregnancy: A Global Perspective, Palace of San Clemente, Venice, April 2009; illustrated in larger-than-life full body prints in an accompanying exhibition entitled "Twin Shape: Mirroring of Body Form," on the Island of San Servolo, Venice; printed in abstract form as, Teplica, D. "Iconography of Twins: A Modern Visual Perspective," *Journal of Maternal-Fetal & Neonatal Medicine*, Vol. 22, Supp 1, p. 35, March 2009.

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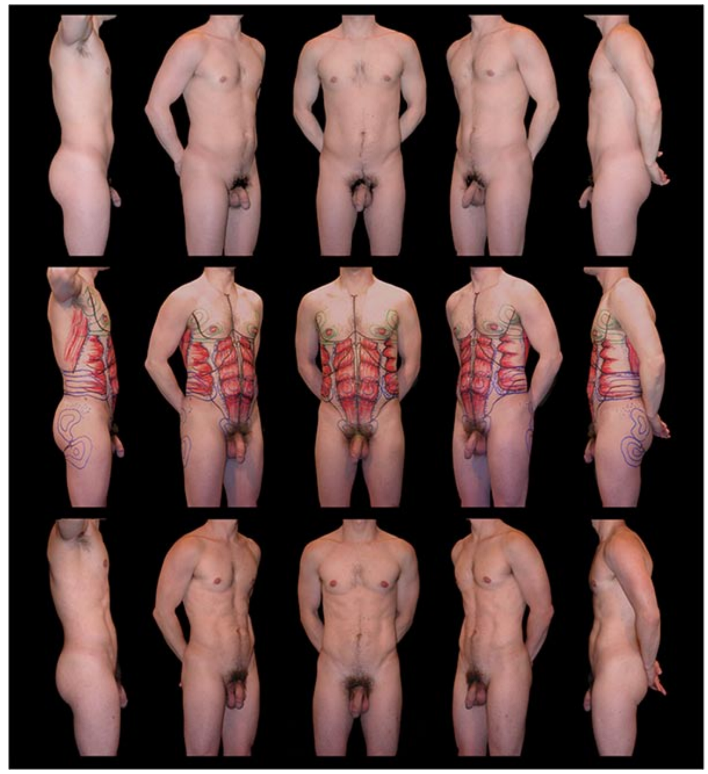

Figure 2. *Composite sequence of standardized photographs of the torso of a healthy man with a stable diet and exercise routine, who underwent High Definition Circumferential Lipectomy by the author, using a technique of direct anatomic surface evaluation and mapping. Before intervention (top row); preoperatively marked (middle row); and 15-month postoperative (bottom row).*

Figure 3. *Standardized digital subtraction analysis of anatomic conformational changes resulting from circumferential full body re-contouring surgery in a healthy young female following 100 pounds of weight loss (preoperative minus postoperative views).*