Response to “The Limitations of Three-Dimensional Simulations in Breast Augmentation”

Jason Roostaeian, MD, William P. Adams, Jr, MD
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We were surprised to receive a Letter to the Editor on our manuscript even prior to the print publication of the study (based on OnlineFirst publication), another sign of the increasing reach and visibility of Aesthetic Surgery Journal. When we initially saw Dr Swanson’s letter, we thought it was an editorial on 3D imaging rather than a Letter to the Editor. In fact, we were downright inflamed based on some of the critiques; however, our senior author (Dr Adams) recently met Dr Swanson in New York at a meeting where we were both presenting and were able to discuss the relevant points. The conversation started out with, “dude, you sure didn’t like our 3D imaging article!” After some good, productive conversation, I think both parties were better off and more understanding of the other’s position. Imagine “that” - specific differences actually discussed without any digital communication turbidity! Probably another life lesson for all of us. Nevertheless, we are happy to respond to this letter, and our response is (similar to our recent conversation) meant to be a professional debate with no ill-will intended.

This commentary is full of unsupported opinions, half-truths, plays on words, and inaccurate conclusions, with the primary one being the last sentence: Dr. Swanson says, “in the meantime, it is best to candidly advise patients that this technology is not yet ready to accurately predict their postoperative breast appearance.” That opinion is clearly disproved by our study. Good science trumps this misguided logic. We are not sure if he has a personal issue with 3D technology or industry, but our study proves that breast augmentation 3D imaging is indeed ready for prime time.

Dr Swanson attempts to call our methodology into question. We would suggest, however, that track record is everything. Dr Swanson has been previously cited for inappropriate use of photographic logic in a publication, and his opinion regarding the simulations in our study is perplexing. We wonder if Dr Swanson believes his subjective “eye” is superior to our objective data? We would argue otherwise. Volumes and surface contour were accurately measured in this study. The 252 mm² was indeed a misprint and should have been 252 cm². Thank you for pointing this out. The root mean square (RMS) surface topography analysis we used has the highest mathematical accuracy possible, and an accepted standard for analysis of 3D surface contours. We would advise Dr. Swanson to carefully re-read the manuscript, results, discussion, and conclusion prior to rendering judgment. We found the simulated volumes to be 90% accurate and the surface contour to show an average deviation of 4 mm based on the RMS. The 98.5% percentage we used was, as specifically stated in the discussion, an extrapolation, as it helps both surgeons and patients put our findings into more tangible terms. Dr Swanson calls into question the methods behind our extrapolation as “not accounting for units of measurement,” which is why we originally omitted it from our results and called it an extrapolation.

Nevertheless, since the question was raised we have gone back and analyzed the data in a different way (one that is not an extrapolation) to more accurately determine if we were wrong and to better quantify the differences in surface topography as a percentage. We compared the RMS (mm) of the preoperative 3D image versus the 3D simulation against the RMS value of the preoperative 3D image versus the 3D image of the actual postoperative result. Using this methodology one can directly compare the two RMS values, which represent deviation of the surface topography from the preoperative control, as a difference in

Dr Roostaeian is an Assistant Clinical Instructor in the Division of Plastic Surgery at the University of California–Los Angeles. Dr Adams is an Associate Clinical Professor of Plastic Surgery at the University of Texas Southwestern Medical School, Dallas.

Corresponding Author:
Dr William P. Adams Jr, 6901 Snider Plaza, Suite 120, Dallas, TX 75205.
E-mail: wpajrmd@dr-adams.com
percentage (Table 1). The mean RMS for the preoperative 3D image versus the simulation was 15.04, while the mean RMS for preoperative 3D image versus the postoperative 3D image was 15.64. This represents a mean RMS difference of 0.6 mm, which equates to a 4% difference and 96% accuracy. This is indeed very close to our prior extrapolation of 98.4%, and not a statistically significant difference. More importantly, this number is actual (not an extrapolation) and negates Dr Swanson’s opinion that 3D imaging technology is inaccurate and not ready to be used as a consultation tool for patients.

Moreover, other errors in this letter include the notion that neither measurements nor real patient data have been included in the simulation algorithm. It is our perception that he is not familiar with the most current 3D imaging technology. Surely Dr Swanson does not believe the simulation algorithms were developed without clinical input and data! We are struggling to understand this logic. Dissecting the algorithm of the Vectra system was not the purpose of this study, but more importantly the point was to determine whether the current algorithm translates into accurate simulations. A monumental amount of clinical data has been used to refine the 3D imaging breast algorithm so that it is indeed highly accurate. To be complete, however, measurements are an integral part of tissue-based planning, but not the only factor to refine simulations. Optimal fill volume is a well-known and proven principle of tissue-based planning. Dr Swanson writes, “who defines optimal fill?” We suggested he read the previous sentinel publications,3,4 it is the surgeon who can easily define optimal fill with three simple measurements. In fact, understanding the concept of optimal fill (as described in this paper) is likely an important factor in making the 3D simulation algorithm more accurate. As one moves above an optimal fill volume, the upper pole of the breast becomes progressively more full and convex. The Canfield system utilizes these concepts and continuously refines them; nevertheless, when tissue-based planning principles are used, greater than 95% accuracy is demonstrated, as shown in our study. What we have seen as the biggest shortcoming is surgeons using a volumetric approach (non-tissue-based) and selecting implants with much higher volumes than optimal fill. The current software requires manual manipulation to further increase the upper pole fullness in these cases. The vast majority of the cases we perform, however, use optimal fill volume range, which has likely afforded us increased accuracy with 3D imaging as described above. Furthermore, if a patient desires an “augmented” look—above optimal fill—the simulation can be manually adjusted by the surgeon to demonstrate this; however, in this study only default simulations were used.

Reoperation and size exchange in breast augmentation is dependent on many factors, the most important being patient education; this was not mentioned by Dr Swanson. Perhaps Dr Swanson has implant exchange rates of 20% for size changes; however, using the process approach to breast augmentation exchange rates for size have been shown to be under 2%. Three-dimensional imaging is another important tool to minimize implant exchange rates and the most effective communication tool to date to show our patients what they would look like with different implants. Through the data found in our study, based on good science, we know that this technology is highly accurate. In addition, due to the enhanced communication between the doctor and patient, we believe the technology helps further reduce reoperative rates for size exchange. Of note, of the patients used in this study, now three years postoperative, none have undergone a size exchange. Moreover, the study group was a randomly-selected group of 20 consecutive patients. If we randomly selected the last 20 patients done in the senior author’s practice, we believe that the results would show even higher accuracy as the technology has continued to improve and was refined one or two times annually.

Finally, a study is referenced by Dr Swanson as having used the same technology, yet having very different results from ours.5 This is a non-scientific comparison. Dr Swanson cites that this study was “less favorable in their own evaluations” concluding “that only 18.7% of the simulations appeared equivalent to the actual postoperative results.” Is a simulation only valuable if is identical to the outcome?

Our study does not concur with this, and in fact the Swedish authors of that study cited by Swanson also found good value with the technology. Clearly there are major differences in study design between theirs and ours. In the referenced study, accuracy was measured by subjective means (as opposed to objective in our study) as a panel of 7 plastic surgeons gave scores 1-10 (10 = identical) regarding how close the actual postoperative result on a regular 2D photo (as opposed to the 3D image) resembled the preoperative 3D simulation. They determined a mean score of 7.5 over the 52 patients they assessed on various parameters, such as shape and size. These 52 patients were consecutive from a series of 150 patients who were asked to complete surveys on their opinions of their own simulation. Eighty-six percent (86%) felt the simulated image was very accurate in predicting the actual result of their breasts. Only 3% thought it was only a “little accurate.” Perhaps the most significant difference between our study and this study was that they used a version of the Vectra 3D imaging system software that was more than two years older than used in our study. Based on the steep development curve for this technology, this two-year difference represents the relative difference between a flip-phone and smartphone. Despite all of this, the Swedish authors still felt that there was a high level of accuracy and satisfied patients with higher conversion rates (67% to 86%) with the Vectra 3D imaging system, which accurately echoes the findings in our study in terms of overall efficacy. Thus we
would argue that the results from this study are not “much less favorable” than ours.

In conclusion, we feel his letter is largely unsupported opinion based on a very narrow view of the highest level of breast augmentation used with current 3D imaging technology. Clinical research in plastic surgery has often relied upon subjective evaluations. Studies that include objective data with regards to aesthetic outcomes have been relatively scarce; with this 3D imaging technology we were able to provide high-level, scientific, objective data that help eliminate the inaccuracies that come with subjective outcome measures. It is easy to state that one “feels” as though an outcome does not look “90% accurate,” however we know the majority would agree that objective evaluation of measured outcome data supersedes the subjective opinion of a single observer.

Disclosures
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