INTRODUCTION
The rhombic local skin flap is a commonly used method for closure of facial cutaneous defects. Initially described by Limberg in 1928, it has maintained its popularity in large part due to its predictable results and versatility. A multitude of variations of rhombic flap geometry have been published as distinct entities; all are based on the principle of local skin transposition to fill a defect from an adjacent donor site. They differ primarily in height, width, and the angles of the rhombus. A computational model was designed to analyze rhombic flap closures to include variables of transposition angle, flap width, and height, and to determine the effects of these variables on the closure force and strain. This model defines with C-like code, fit to a curve defined with C-like code, for creation of the model. The model visually depicts quantitative properties of rhombic flap closures, and as such can be of value to the surgeon designing local flap closures. Specific principles shown include:

- The Webster angle (e.g. interior angles of 60˚ and 120˚), indicating a minimized standing cutaneous deformity with wound closure.
- A change in the rhombic flap closure angle (e.g. exterior angles of 60˚ and 120˚), indicating a minimized standing cutaneous deformity with wound closure.
- The Webster flap (α = 0, β = 30˚), fit to a curve defined with C-like code, for creation of the model.
- The Limberg flap (α = 50˚, β = 60˚), fit to a curve defined with C-like code, for creation of the model.

RESULTS
Effect of Transposition Angle
The Dufourmental rhombic modification, with altered transposition angle (corresponding to the a angle in the model), was initially designed to broaden rhombic applications to defects not conforming to the 60˚-120˚ Limberg configuration. The model was solved for the Limberg defect and a square defect. The results, as depicted below, show that increasing transposition angle can decrease principal strain for the Limberg defect, but increases strain for a square defect.

Figure 5: Effect on peak strain seen with alteration of transposition angle for a) Limberg defect and b) square defect

Additionally, alteration of flap transposition angle impacts the directional closure force vector, as shown in Figure 6.

Figure 6: Depiction of all primary closure force vector with alteration of transposition angle, with increase from a) α = 0 to b) α = 50

Effect of Flap Width
The Webster modification of the rhombic flap alters flap width and has a defined distal angle of 30˚, and also incorporates a W-plasty into the defect closure to minimize standing cutaneous deformity. This closure essentially provides donor tissue volume smaller than that of the defect, and relies on adjacent wound margin skin advancement, termed secondary tissue movement. In the model, the square transposition modification demonstrates properties of the Webster flap. Figure 7 below shows that the Webster 30˚ B angle confers lower principal strain for the Limberg configuration defect, while it shows an increased principal strain for a square defect.

Figure 7: Effect of changing flap width (e.g. Webster angle) for a) Limberg defect and b) square defect

CONCLUSION
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REFERENCES

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The rhombic local skin flap is a commonly used method for closure of facial cutaneous defects. Initially described by Limberg in 1928, it has maintained its popularity in large part due to its predictable results and versatility. A multitude of variations of rhombic flap geometry have been published as distinct entities; all are based on the principle of local skin transposition to fill a defect from an adjacent donor site. The present study seeks to develop a computational model using the finite element method for the analysis of wound closure forces in an effort to optimize an idealized rhombic flap design.