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Redesign for Improvement and FEA Analysis of Face Shield Holder

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KEYWORDS

Face Shield Holder
Von Mises Stress
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Filling Time

ABSTRACT

Face shields are personal protective equipment devices that are used by many workers for example used in medical, dental and veterinary for protection of the facial area and associated mucous membranes (eyes, nose, mouth) from splashes, sprays, and spatter of body fluids. This research is about redesign of face shield holder's design with aims of improvement on current design in the market. This design of face shield holder is carried out using Autodesk Inventor Professional 2019 than analyzed through Finite Element Analysis (FEA) by using Autodesk Inventor Professional 2019 and Autodesk Moldflow Adviser 2019 to investigate the performance of new design in term of strength, material suitability, filling time and gate suitability. This improvement design of face shield holder give the best performance of strength 27.98 MPa with 4.035 second filling time is required to produce this product.

1.0 INTRODUCTION

Healthcare workers' faces have been reported to be the body part most commonly contaminated by splashes, sprays and spatter of body fluids. A face shield is classified as personal protective equipment (PPE) that provides barrier protection to the facial area and related mucous membranes such as eyes, nose and lips. A face shield offers a number of potential advantages, as well as some disadvantages, compared with other forms of face/eye protection used in healthcare and related fields. The millions of potential users of face shields include healthcare workers, dental providers, veterinary care personnel, laboratory workers, pre-hospital emergency medical providers, police, firefighters and custodial staff dealing with spills and contaminated waste. It is not precisely known when eye protection first came to be used in the medical field, but for a transparent sanitary face shield for protection from inhaling disease producing germs.

Face shields provide a barrier to acutely-expelled aerosols of body fluids and are commonly used as an alternative to goggles as they confer protection to a larger area of the face.

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There is great variance in official governmental and professional society such as medical, dental and guidelines for the appropriate use of face shields in the context of protection from biological hazards.

Healthcare Infection Control Practices Advisory Committee/CDC Standard Precautions guidelines for prevention of transmission of infectious agents in healthcare venues includes the use of face shields (with a medical/surgical face mask) when sprays, splashes, or splatter are anticipated. The World Health Organization's health care facility recommendations for standard precautions include a face shield as an alternative to the use of a medical/surgical or procedural mask with eye protection (eye visor or goggles). Correct use of a face shield is dependent upon the indications for use. Appropriately fitted, indirectly vented goggles offer the most reliable practical eye protection from splashes, but face shields are considered an alternative to goggles for prevention of eye contamination with infectious agents.

2.0 METHODOLOGY

Start from gathering the information about the project and make some research more detail from the many side and part. Selected the title and get the approval from the supervisor about the idea of project and combine some idea to get more improvement or this final year project. Identify the objectives of this project, related to various aspects, especially the usefulness, improvement and advantages of this project. Start by designing new idea to create innovation at previous product by using Autodesk Inventor Professional 2019. Autodesk Mold Flow Adviser and Autodesk Inventor Professional are the software to make simulation and analysis for this final year project. From the end of project, the data of analysis is to define the design is more usefully and proceed to the 3D printer.

3.0 RESULTS AND DISCUSSION

Figure 1: Current Design 1

Based on the Figure 1 above, current design 1 is not full covered at the front product. This current design got comment from user that this product was slowly loose after long time period used and got durability issue.

Figure 2: Current Design 2

Based on the Figure 2 above, current design 2 came out with gap between forehead and shield. This current design just came out with that advantage but need to get one more things to assemble before wearing it.

Figure 3: Current Design 3

Based on the Figure 3 above, current design 3 came out with gap between forehead and shield too but at the back of the product widely open and user comfort issue as same as current design 1.

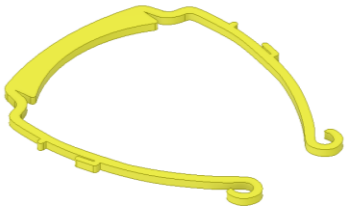

Figure 4: Design Concept 1

Based on the Figure 4 above, design concept 1 is commonly use nowadays. This current design is full covered at the front product. This current design got comment from user that this product was slowly loose after long time period used and got durability issue.

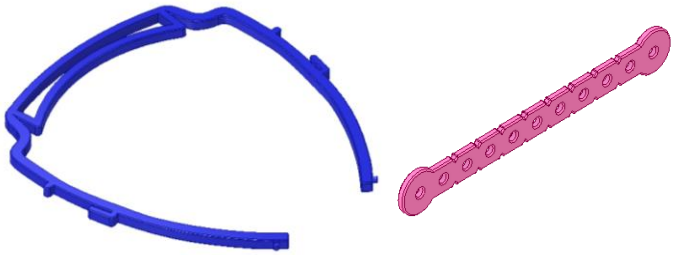

Figure 5: Design Concept 2

Based on the Figure 5 above, design concept 2 is contain double parts which are face shield holder current design and hook. This two parts need to assemble together while wearing it. This current face shield design has space at the front product.

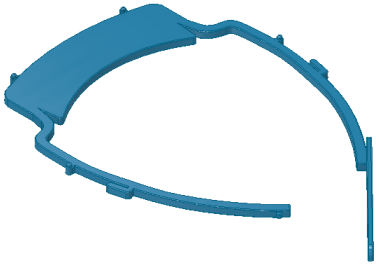

Figure 6: Design Concept 3

Based on the Figure 6 above, design concept 3 has extended which is 20 mm from forehead and has a clipper to tighten. The extended is full covered not has any space through it.

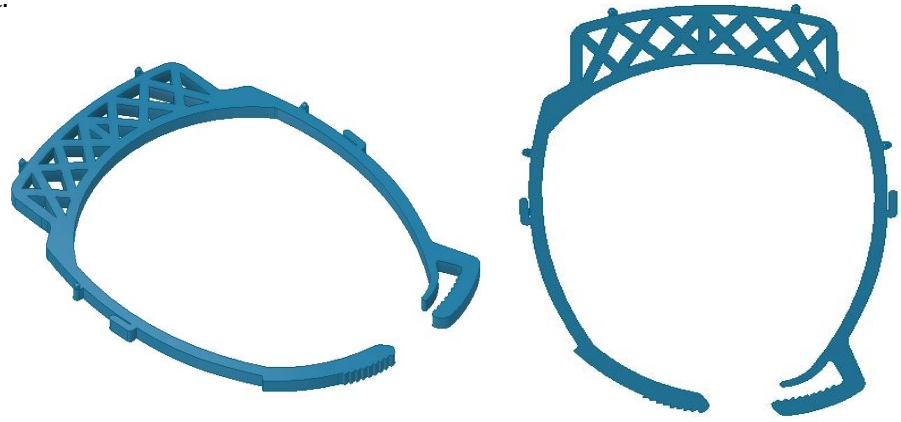

Figure 7: Final Design

Based on the Figure 7 above, this is the final design for this project. This design came out with the extended at the front and connector tightening at the back in order to prevent discomfort and durability issue.

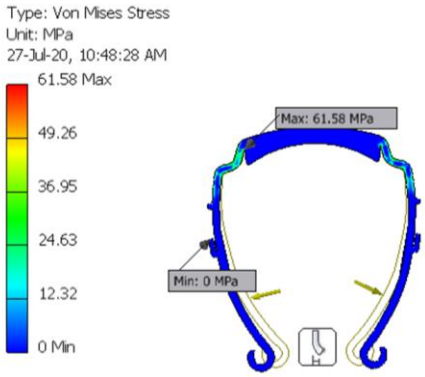

Figure 8: Analysis Current Design (Von Mises Stress)

Figure 8 shows the Maximum Von Mises Stress of current design which is 61.58 MPa. The red colour area on the figure above shows where the maximum stress occurs.

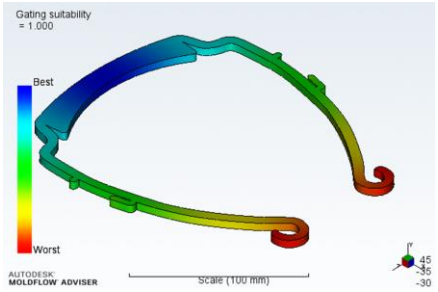

Figure 9: Gating Suitability

Figure 9 shows the Gating Suitability of current design. The blue colour area on the figure above shows where the best gating suitability. The most suitable areas are rated from most suitable (best) to least suitable (worst).

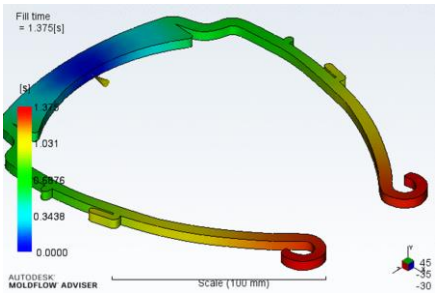

Figure 10: Filling Time

Figure 10 shows the Fill time of current design which is 1.375(s). The red colour area on the figure above shows where the longest time taken to fulfill the product.

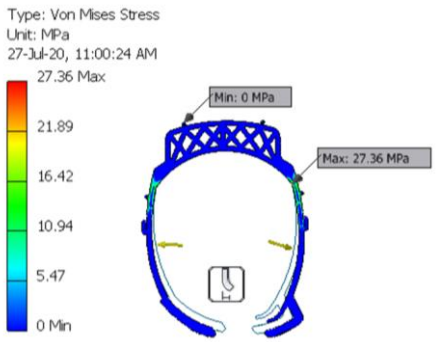

Figure 11: Latest Design (Von Mises Stress)

Figure 11 shows the Maximum Von Mises Stress of latest design which is 27.36 MPa. The red colour area on the figure above shows where the maximum stress occurs.

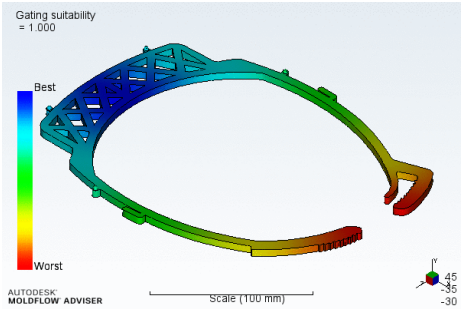

Figure 12: Gating Suitability of final design

Figure 12 shows the gating suitability of final design. The blue colour area on the 9igure above shows where the best gating suitability. The most suitable areas are rated from most suitable (best) to least suitable (worst).

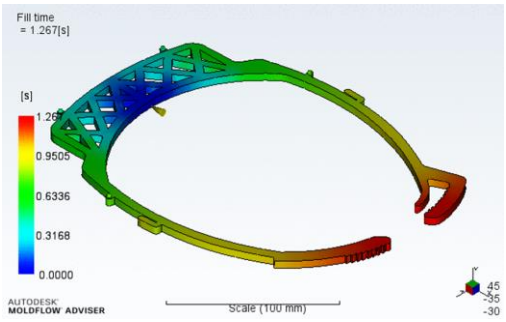

Figure 13: Filling Time of final design

Figure 13 shows the fill time of final design which is 1.267(s). The red colour area on the figure above shows where the longest time taken to fulfill the product.

4.0 CONCLUSION

The main focus for this project are to redesign an improvised face shield holder with relevant analysis to produce a good and high quality of product in order to prevent discomfort and durability issue. The face shield holder is already successfully designed using Autodesk Inventor Professional 2019 and analyzed through FEA by using Autodesk Inventor Professional 2019 and Autodesk Moldflow Adviser 2019. All the objectives have been achieved.

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