RISKS OF WEARING PENDULOUS EARRINGS – A KINEMATIC STUDY*

Elisa Strobel do Nascimento[1], Noé Gomes Borges Júnior[2], Donato Gonçalves do Nascimento[3], Marcelo Gitirana Gomes Ferreira[4], Susana Cristina Domenech[5]

State University of Santa Catarina, UDESC CEART, Av. Madre Benvenuta, 2007, Florianópolis, Santa Catarina, Brazil, 88.035-001

[1] elisastrobel@gmail.com, [2]noe.borges@uedsc.br, [3] donatonasc@gmail.com, [4] marcelo.gitirana@gmail.com, [5]scdomenech@gmail.com

Keywords: Human Factors, Kinematics, Pendulous Earrings

1 Context

The torn earlobe is probably the most common traumatic complication related to wearing earrings (LANE and O`TOOLE, 2011). British plastic surgeon James McDiarnid described an increase of 20% in people looking for earlobe treatments every time big earrings were back to fashion (ESTRIDGE, 2009). In India, where the use of big pendulum earrings is a tradition, plastic surgeons perform about 7 to 10 earlobe procedures a month (RAINA, 2010). In Brazil as well, Oliveira et al. (2011) described the search for torn earlobe correction very usual on the daily dermatologists and plastic surgeons practice.

There are authors like Reiter and Alford (1994) that don`t even recommend the wear of earrings with pendulums at all and remark that the risk is even more serious for individuals with earlobes thinner than 4mm.

It is key for designers to ensure the user`s safety and comfort. This study analyses pendulum earring moves projecting the forces applied to the earlobe, looking to better understand the relation of this object to the discomforts and the injuries appointed by the literature.

* Reviewed article presented at 14º Ergodesign congress, 2014, Joinville and published in the Anals of ERGODESIGN 2014, 2014.

2 Method

The analysis was performed on a 27 year old female, her earring holes were positioned 10mm from the inferior border of the earlobe with no lesion marks.

Images were acquired through a camera on 1920x1080p, 60 frames/s. Data was analyzed on Kinovea and Microsoft Excel. Earring mass and dimensions were measured by analytical balance and caliper. Two reference points (2,5mm circles of reflexive tape) were placed, one at the pendulum extremity, and one at the anthropometric reference point *Zygion*. The earring pendulum weighted 3.5g plus 0.1g from the fixture hook, 3.6g mass total. The pendulum maximal dimensions were 81mm x 50mm.

As the reference point was not fixed on the pendulum`s mass center, it had to be recalculated. Considering the complex movement of the elastic earlobe and the hook on the hole – following simplifications to estimate pendulum speed and forces are proposed:

1 – The movement was considered bidimensional – with the reference points on the same plane.
2 – The earring motion in relation to the earlobe was taken as circular – for speed estimation on the mass center.
3 – The ear is taken as rigid, disregarding deformations between the rotation point (pendulum-hook connection) and the *Zygion* reference point.

The subject performed the activities on a treadmill adjusted to 1.17m/s (4.2km/h) – similar speed used in shoe comfort testing regulated by NBR 14834:2011 (ABNT, 2011). The camera was positioned parallel by the earring, and in its height;

Two sets of activities were analyzed: In 13s 10 steps, one light jump, an abrupt stop and one heavy jump; In 3s 1 step and 5 heavy jumps.

3 Results

Through the analysis, it was clearly visible how distinct the trajectory between *Zygion* and Pendulum reference points is. The Pendulum reference point develops a greater displacement and a more complex trajectory.

On the first set of activities, while the subject walks, the pendulum point draws a turned “D” shape trajectory. The estimated strength peaks on the earlobe occur while the point passes from half the “semicircle” and returns to the straight line. However, the strength was greater as the subject suddenly stopped, after the light jump – because of deceleration. The Pendulum trajectory on the second activity set was completely chaotic.

On the first activity set, where the simplification suggested on this study is closer to reality, the estimated peak of strength imposed by the earring to the earlobe is about 0,1732N, or 17,32gf. At his scenario the earring “weights” actually almost 5 times more than it`s original 3.6gf. There are even heavier earrings on market, some can reach 14g each.

The tolerable earring weight is different for each subject (UNTRACHT,2001). Copruchinski (2011) tells an earring for everyday use shouldn`t go over 7g per ear. For Mancebo (2008) and Olver (2000) it shouldn`t pass the mark of 10g, otherwise it would cause the subject discomfort.

Mancebo (2008) and Morton (1970) suggest coordination of earring weight to earring fixation. Some authors consider the hook and the post fixation styles inadequate for heavy jewelry (COPRICHINSKI 2011; MANCEBO, 2008). Morton (1970), Olver (2000) and Copruchinski (2011) indicate the Omega fixation for heavy pieces, which adds an earring post to a pressure attachment system. Alternatively, a bigger earring back may be used. These solutions attempt to improve stability of the pendulum to the earlobe, reducing the effect of great acceleration changes.

4 Conclusions

Through this study the very distinct behavior of a pendulum earring is observed. There are many variables interacting to its movement pattern such as ear elasticity, the movement of each assembly joint and collisions with the use`rs head and neck.

On this study, a pique of force was estimated after an abrupt stop of the subject: 0,1732N, or 17,32gf - which represents almost five times the actual 3,6gf of the earring. This effect should be even more critic considering earrings with a higher mass or with longer pendulums, easily found available on the Market.

This type of earring contributes to the problem of the torn earlobe, because of it`s particular movement behavior and because it usually offers a bigger surface and is more prone to a sudden trauma. Thereby this study supports the recommendations made by Reiter and Alford (1994): pendulum earrings should not be worn by subjects whom already had their earlobes torn, or whom have thin earlobes.

Designers should acknowledge this effect, to ponder the weight on such jewelry project.

The authors suggest further studies to this artefact, many times considered as an artistic object, underestimating it`s effects to health and comfort.

5 References

1. ABNT. Conforto do Calçado – Requisitos e Ensaios. ABNT NBR 14834:2011.
2. BONE, Elizabeth. Silversmithing for jewelry makers: a handbook of techniques and surface treatments. Loveland, USA, Interweave Press, 2012.
3. BONE, A.; NCUBE, F.; NICHOLS, T.; et al. Body piercing in England: a survey of piercing at sites other than the earlobe. BMJ, V.336, n.1426, p.1426-1428. [S.l.]: 2008;
4. BREPOHL, Erhard. Theorie und praxis des Goldschmieds. Leipzig. Fachbuchverlag Leipzig. 16 Auflage, 2008.
5. COLES, Madeline. Jewelry Two Books In One: Projects to Practice & Inspire * Techniques to Adapt to Suit Your Own Designs, Sterling Publishing, New York, USA, 1999.
6. COPRUCHINSKI, L. A Arte de Desenhar Jóias. Brasil, Editora Autores Paranaenses, 2011.
7. ESTRIDGE, B. Dynasty-style chandelier earrings blamed on the rise of the lobe lift. Daily Mail, 2009, disponível em: <http://www.dailymail.co.uk/femail/article-1161980/Dynasty-style-chandelier-earrings-blamed-rise-lobe-lift.html#ixzz2iqSK6h4r>, Acesso em: 09 Setembro, 2013.
8. HENDRICKS, W. M. (1991). Complications of ear piercing: Treatment and prevention. Cutis, 48(5), 386-394
9. HWANG, K.; HWANG, P. Which type of earring and which piercing point is safest with regard to tearing through the ear by an external force? Dermatologic surgery : official publication for American Society for Dermatologic Surgery [et al.]. V. 38, N. 5, p.772-777. [S.l]: 2012.
10. LANE, J. C.E.; O'TOOLE, G. Complications of ear rings. Journal of plastic, reconstructive & aesthetic surgery by Elsevier Ltd.: JPRAS. V. 65, n. 6, 2011.
11. MACGREGOR, D. M. (2001). The risks of ear piercing in children. Scottish Medical Journal, 46(1), 9-10.
12. MANCEBO, Liliane de Araujo. Guia prático para o desenho de jóias, bijuterias e afins. Novo Hamburgo, RS: Feevale- teste L. Curitiba, 2008.
13. MASCETTI, D.; TRIOSSI, A. Earrings: From Antiquity to the Present. Londres: Thames & Hudson, 1999.
14. MORTON, Philip. Contemporary Jewelry: A Studio Handbook. USA. Holt, Rinehart and Winston, Inc., 1970.
15. OLVER, Elizabeth. The Jeweller's Directory of Shape and Form. A. & C. Black, Great Britain, 2000.
16. RAINA, S. Earlobe surgery on rise, heavy earrings blamed. Mathrubhumi, 2010, Disponível em: < http://www.mathrubhumi.com/english/story.php?id=97936>, Acesso em: 09 Setembro, 2013.
17. REITER, D.; ALFORD, E. L. Torn earlobe: A new approach to management with a review of 68 cases. Annals of Otology, Rhinology and Laryngology, v. 103, n. 11, p. 879-884, 1994.
18. RIBEIRO, A. A.; LOURENÇO, L. de M.; MATSUDA, T. H. C. de B; Reparo do lóbulo da orelha partido: revisão da literatura e proposta de nova técnica. Surgical & Cosmetic Dermatology Journal, v. 1, n. 3, p. 141-144, 2009.
19. SALEM, Carlos. Jóias: criação e modelagem. São Paulo: 2000jóias, 2002a.
20. SALEM, Carlos. Jóias: os segredos da técnica. São Paulo: 2000jóias, 2002b.
21. SIMPLOT T.C.; HOFFMAN H.T. Comparison between cartilage and soft tissue ear piercing complications. Am J Otolaryngol, V. 19, n.5, p.305–310, 1998.

22. STROBEL, E., SANTOS, F. A. N. V., DOMENECH, S. C., Ferreira, M. G. G. Requisitos De Projeto Para Brincos Mais Seguros E Confortáveis: Uma Revisão Da Literatura Científica In: Anais do 13º Ergodesign e 13º USIHC: 13º Congresso Internacional de Ergonomia e Usabilidade de Interfaces, 2013a.
23. STROBEL, E., DOMENECH, S. C., VANDRESEN, M., REIS, A. A. dos, FERREIRA, M. G. G. Requisitos De Projeto Para Safety And Comfort Requirements For Earring Design: A Review Of Technical Literature. In: International Conference on Integration of Design, Engineering and Management for Innovation, 2013, Porto. Anais do iDEMi2013. 2013b.
24. TIONG , W. H. C.; SATTLER, T.; O'SULLIVAN, S. T. A case of double buried earrings in earlobes: uncommon complication. Journal of European Journal of Plastic Surgery. V.31. n. 1, p.29-31, 2007.
25. UNTRACHT, Oppi. Jewelry Concepts and Technology. Robert Hale & Company, Great Britain, 2001.
26. VAN WIJK, M.P.; KUMMER, J.A.; KON, M. Ear piercing techniques and their effect on cartilage, a histologic study. Journal of plastic, reconstructive & aesthetic surgery By Eslevier: JPRAS. V.61, n.1, s104-s109, 2007
27. VUJEVICH, JUSTIN ; GOLDBERG, LEONARD H. ; OBAGI, SUZAN. Repair of partial and complete earlobe clefts: a review of 21 methods. Journal of Drugs in Dermatology, July, 2007, YOUNG, Anastasia. Directorio de Materiales y Técnicas de Joyería /
28. Jewelry Techniques: The Essential Guide to Choosing and Using Materials, Stones, and Settings. New York, Potter Craft, 2008.Vol.6(7), p.695(5)
29.
30. AUTHOR, A et al . Title. Publication. Editor: City, year. Number of edition, total number of pages.

6 Acknowledgments

The authors gratefully acknowledge PPGDesign from the State University of Santa Catarina for the research opportunity and CAPES for the support.