Dental Fear and MC1R Genotype: Fear of Pain as Mediator  

Center for Oral Health Research in Appalachia (COHRA)  
Cameron L. Randall, John R. Shaffer, Daniel W. McNeil, Richard J. Crout, Robert J. Weyant, & Mary L. Marazita  
West Virginia University & University of Pittsburgh

Background

- Dental fear is a prevalent and important problem.  
- 45 million adults in USA with moderate fear; 10-20% report severe levels (Moceri et al., 1986; Suss & Heaton, 2012)  
- Fear is associated with avoidance of treatment and other poor oral health behaviors (e.g., Arndt et al., 2007; Meng et al., 2007)  
- Fear and avoidance are associated with:  
  - oral health status (e.g., Arndt et al., 2009; Randall, McNeil et al., 2013)  
  - lower quality of life and self-esteem (Chiu & Barnes, 2013)  
  - diabetes, cardiovascular disease, neurocognitive problems, poor pregnancy outcomes (e.g., Offerbacher et al., 2015)  

- Fear of pain is a critical component of dental fear (Roth & Bell, 1985)  
- Detailed conceptualizations of both dental fear and fear of pain have been established, but most have failed to explicitly include the role of genetics  
- Recent work suggests that there are genetic contributions in the etiology of dental fear  
- Dental fear is moderately heritable (Randall, Shaffer et al., 2013)  
- Melanocortin-1 Receptor (MC1R) gene variants are associated with dental care-related fear (Brinkley et al., 2009)

The aims of this study were to:  
1. confirm the previously reported association between MC1R variant status and dental fear  
2. examine how MC1R variant status is related to fear of pain  
3. determine whether fear of pain mediates the relation between MC1R variant status and dental fear

Method

Utilized existing COHRA data from a large, family-based cross-sectional study on determinants of oral diseases at the community, family-, and individual levels (Marazita et al., 2005; Polk et al., 2008; Randall, McNeil et al., 2013)  

Participants  
732 households (containing at least one biological parent-child pair) enrolled; For data analyzed, sample included age 21 and older (N = 920, 64% female)  
Mean age = 35.2 years (SD = 8.7, range = 21-74)

Self-Report Assessment Instruments  
- Demographic questionnaire  
- Fear of Pain Questionnaire-9 – FPQ-9 (McNeil et al., 2015)  
- Dental Fear Survey – DFS (Kleinknecht et al., 1973)

DNA Collection, Genotyping, and Risk Score Calculation  
- DNA collected for all participants from blood, saliva, or cheek swab samples; Genotyped on Illumina platform  
- Labeled the following MC1R SNPs as “variant”: rs1805006, rs11547464, rs1805007, rs1110400, rs1805008, rs1805009 (as in Brinkley et al., 2009)  
- Genetic data combined across variants to calculate risk score (positive variant status – one or more MC1R variants; negative variant status – zero MC1R variants)  

Data subjected to mediational (simple & multiple regression) analyses, utilizing Baron & Kenny (1986) approach

Results

- Consistent with existing literature, 31.2% of the sample had MC1R variants  
- As has been demonstrated before, MC1R variant status predicted dental fear, controlling for age and sex (β = .07, p = .05)  
- MC1R variant status also predicted fear of pain, controlling for age and sex (β = .07, p = .02)  
- Fear of pain predicted dental fear, controlling for age and sex (β = .50, p < .001)  

Fear of pain mediated the relation between MC1R variant status and dental fear (β = .51, p < .001, R²= .25)

Table 1. Final Regression Model: Predicting DFS Score

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>Unstandardized regression coefficient (B)</th>
<th>Standard Error</th>
<th>Standardized Regression Coefficient (β)</th>
<th>Significance Value (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>.005</td>
<td>.02</td>
<td>.01</td>
<td>.72</td>
</tr>
<tr>
<td>Sex</td>
<td>1.63</td>
<td>1.2</td>
<td>.04</td>
<td>.17</td>
</tr>
<tr>
<td>MC1R Variant Status</td>
<td>1.10</td>
<td>1.2</td>
<td>.03</td>
<td>.36</td>
</tr>
<tr>
<td>FPQ-9 Score</td>
<td>1.19</td>
<td>.07</td>
<td>.51</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>

Figure 1. Fear of Pain Mediates Relation between MC1R Variant Status and Dental Fear

Conclusions

- Fear of pain mediates the relation between MC1R genotype and dental fear  
- Thus, genetic factors, and particularly the MC1R gene, play an important part in the etiology of dental fear  
- Future experimental work will determine the mechanism by which the MC1R gene is associated with fear of pain and dental fear, with particular attention paid to its role in dental pain sensitivity  
- These results enhance our conceptualization of dental fear and, with additional work, may offer potential targets for intervention in the treatment of dental care-related fear and anxiety to improve dental treatment-seeking behavior

Contact & Support

Cameron L. Randall  
53 Campus Drive, Box 6040  
Morgantown, WV 26506-6040  
CRANDAL1@mix.wvu.edu  
www.cameronlrandall.com  

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