



Plastic Deformation...*not* Melting

*...the apically-warmed gutta percha is only heated
2 to 3 degrees C above body temperature*

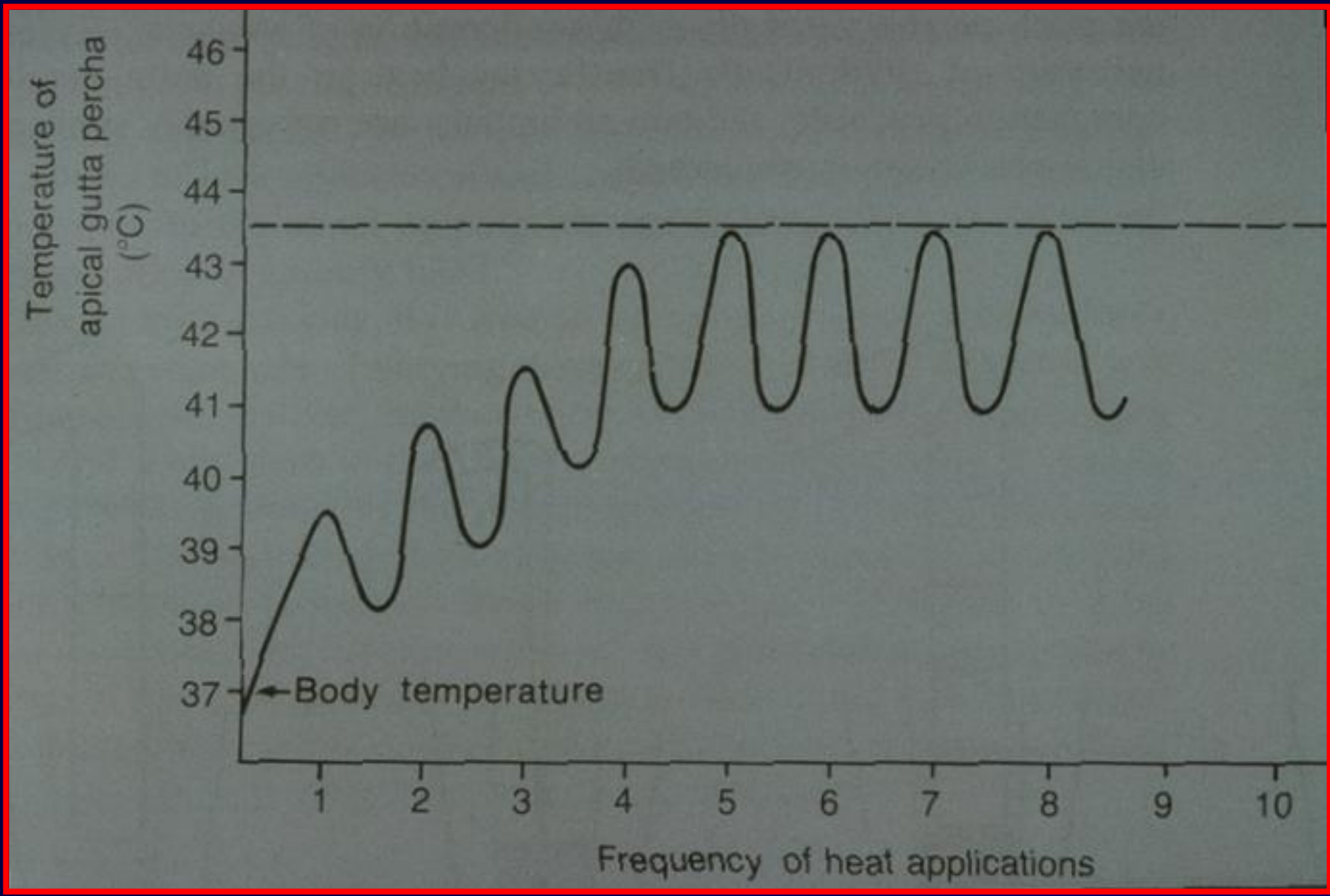
Gutta Percha is a complex molecule of rubber that goes through 3 distinct phase changes as temperature is increased...

ALPHA -> BETA -> AMORPHOUS

...these phase changes result in significant changes in volume and shrinkage

*Techniques that require **direct** heating of the gutta percha undergo phase changes and effect the seal.*

- 1. Gutta percha coated obturators**
- 2. Injection techniques**
- 3. Continuous heat delivery units**



Thermomechanical Properties of Gutta-Percha

Goodman, A.

Master's Thesis, Boston University School of Graduate Dentistry, 1973

Measured volume changes of gutta percha as it was subjected to temperature during the vertical compaction of warm gutta percha

Goodman Results:

1. **Temperatures of only 3-8 degrees C above body temperature are needed to mold apical gutta percha**
2. **Thermal penetration into gutta percha seldom exceeded 4 - 6 mm from the tip of the heat carrier**

..... and

Goodman Results (cont.):

3. **Peak temperature of coronal gutta percha is 80 degrees C and 45 degrees C in the apical 2mm**
4. **The apical segment of gutta percha rarely exceeds 45 degrees C**

.....and

Goodman Results (cont.):

5. When gutta percha is heated from room temperature to 80 degrees C and cooled to body temperature (37 degrees C), there is a 1 % loss of volume relative to the original volume at room temperature
6. When heating gutta percha from room temperature to 45 degrees C and cooling to 37 degrees C there is a net increase in volume of 1.3%