

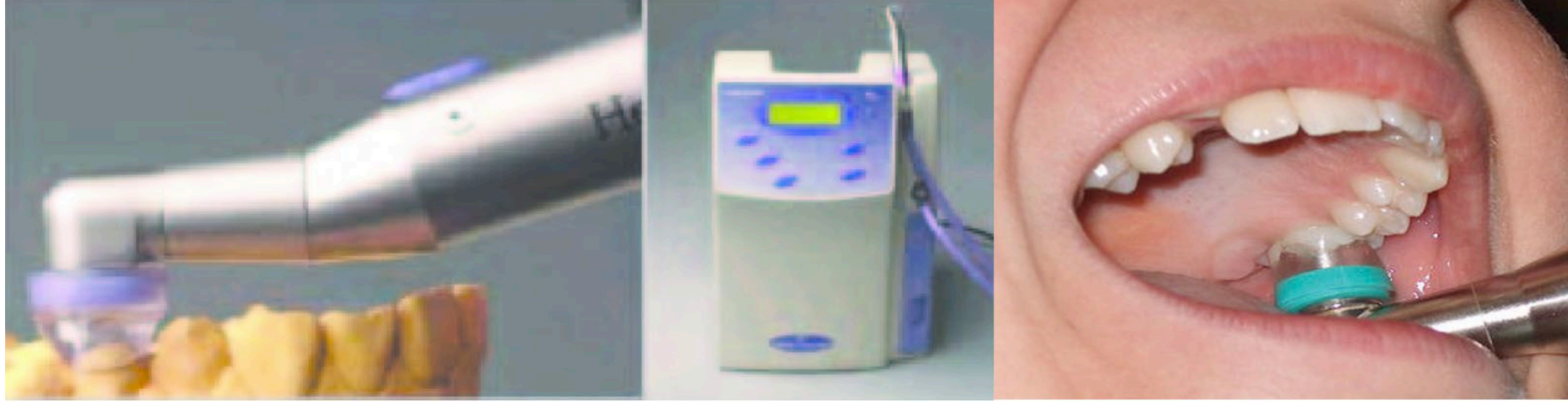
## Introduction

The recent advances in science and technology helped mankind achieve things that were previously thought impossible or at least centuries away. The field of Dental Medicine is no exception. Aided by both Academia and Corporations, scientists and dental professionals collaborated and engaged in inter-disciplinary research. To solve the problem statements in Oral Health, the community resorted to other fields such as Artificial Intelligence, Radiography, Genetic Engineering, Electronics, Spectroscopy, and most recently Printing. The results include a variety of innovative dental treatment methods and oral healthcare products that are helping the progression of global dental medicine.

Below, we attempt to present some of the most recent and high-impact tools such as HealOzone, VELscope, Smart Brush, Smart Brushes, GalvoSurge, CRISPR, Diagnodent, and 3D Printers.

## HealOzone

- Caries removal without cavity preparation. It involves direct application of ozone gas to the caries lesion
- HealOzone is an oxygen generating system that adds ozone to the part of the carious tooth. It then converts ambient oxygen into ozone oxide
- Research has shown that 99% oral bacteria can be destroyed by as little as 10 sec
- Research shows that ozone therapy are faster than the conventional restorations



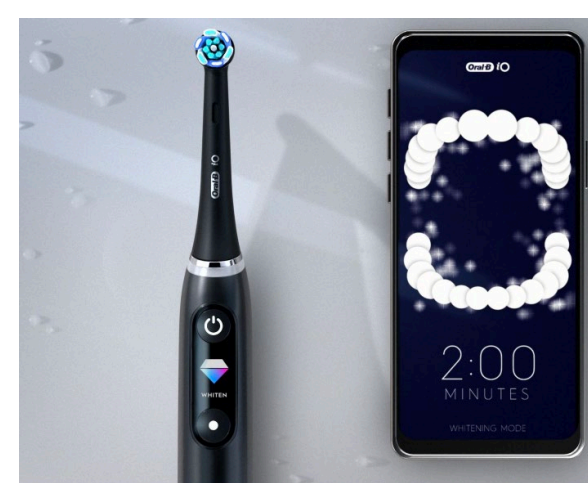
## VELscope

VELscope (Visually enhanced lesion scope), it's a light induced fluorescence visualization appliance. Used in assessing the cellular changes occurring in oral premalignancies. It uses special wavelength of 400-460 nm, penetrates the epithelial layer and the basal layer reaching the stroma. Indicators: Blue light- Normal tissues and different dark green colors reaching black color- Abnormal tissues



## Smart Brush

- Makes use of Inertial sensors embedded with IMU
- The smart brushes are different from the electric brush as they are connected via Bluetooth and uses AI technology to detect the brushing and non brushing area
- Research Suggests that there is a need for smartphones to integrate AI accelerators for instant brushing recognition and use of RPNN model migration method.



## Dental Implants: GalvoSurge

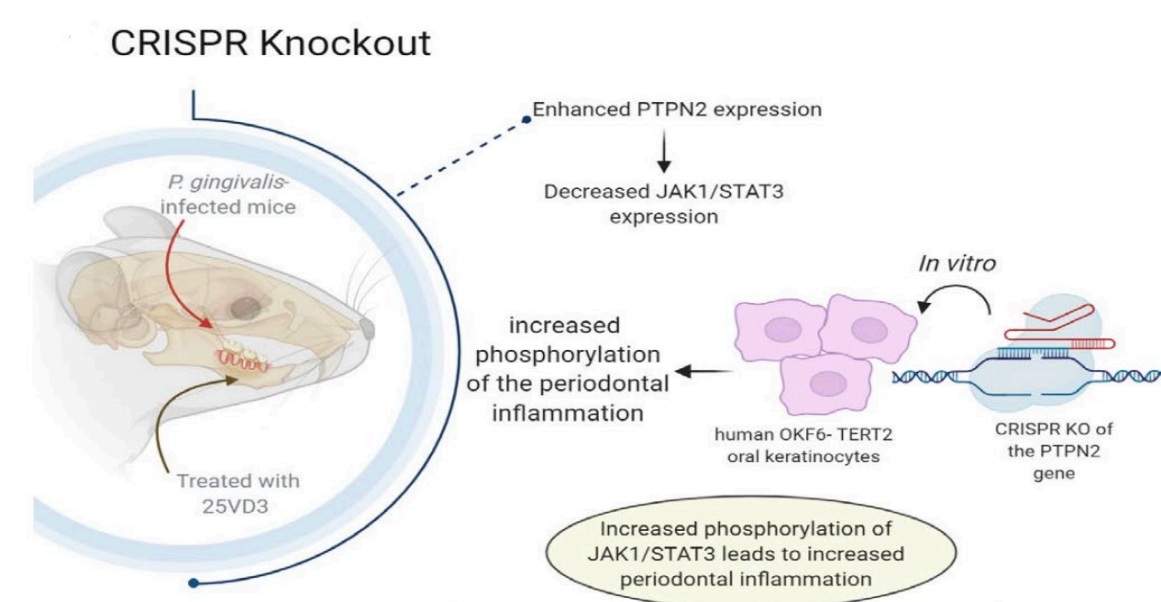
- Galvo surge is a newer method to remove biofilm from the dental Implant by decontaminating the surface. It uses an electric current on an implant treated with sodium formicate. Anion: OH- and cation: H+ are dissociated by the current. It works by creating hydrogen bubbles on the implant surface thereby breaking the biofilm. Thereby preventing peri-implantitis
- Cleaning with GalvoSurge helps in re-osteointegration
- In vitro data has proven that the GalvoSurge method removed oral biofilms better than the current gold-standard cleaning implants procedure.



## CRISPR

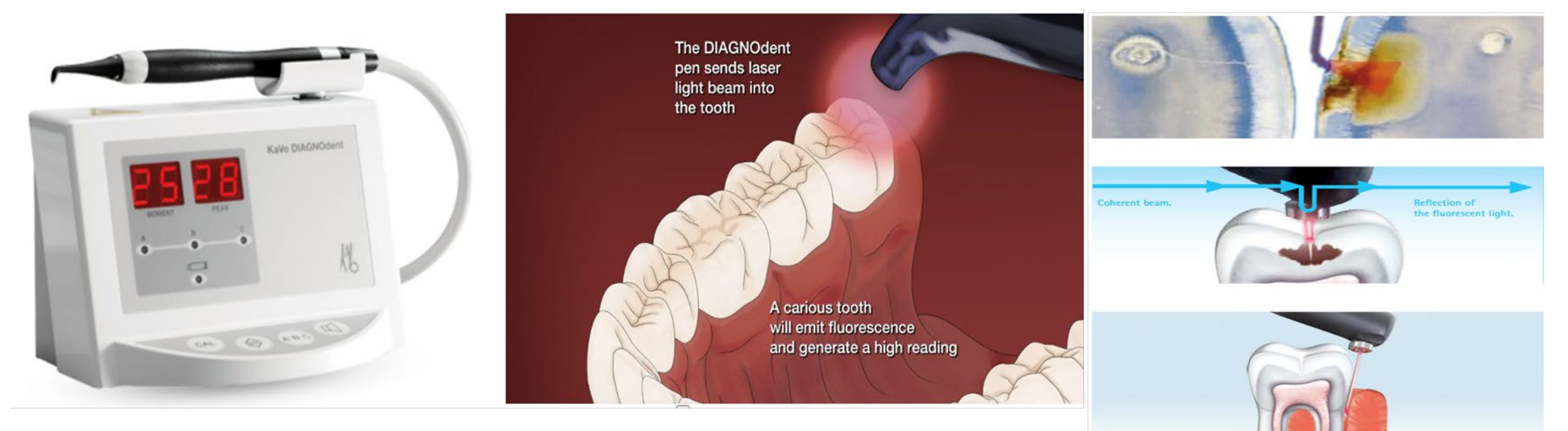
### Clustered Regularly Interspaced Palindromic Repeats

- MOA: Bacterial defense by identification and destruction of the DNA segments during bacteriophage invasions
- CRISPR in Dentistry help to identify the causative genes for dental caries
- It aids in the identification of genes that suppress the tumor-promoting properties of oral cancer
- CRISPR Cas3 is used to target the periodontal biofilm in order to reduce or eliminate periodontal pathogens by detecting and destroying DNA fragments during subsequent bacteriophage invasions
- Cas9 could be used as a screening tool to identify cellular pathways for periodontal pathogenicity
- Cas9 induces gene editing. In the "knockout strategy", certain proteins have been identified for periodontal inflammation. Studies have shown that knockout of the PTPN2 gene could increase the phosphorylation of periodontal inflammation-JAK1 and STAT3 demonstrating a role of PTPN2 to restrict periodontal inflammation
- CRISPR-Cas9 knockout of insulin-like growth factor 2 mRNA-binding protein 1 which inhibits LPS-induced p65-p52 nuclear translocation and NFkB activation, has been found to have reduced the inflammatory response causing alveolar bone loss
- Cas13: can modify transcriptomes and gene expression without altering the DNA sequence and could possibly be used in a clinical setting



## DIAGNOdent

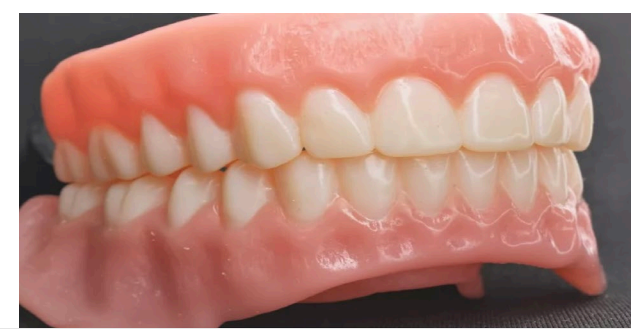
- DIAGNOdent uses laser light of different wavelengths. The wavelength used in caries detection is 655 nm.
- Fluorescence reflection #0-#99 are used as markers for caries detection. The greater the number, the greater is the decay.
- It is very helpful in the early detection of decay and effective in spotting the smallest lesion
- The light emitting device is held against the tooth surface and it analyses the decay
  - 0-10: No caries or its initiation on the enamel surface
  - 10-20: Caries in the enamel or Outer surface of the dentin
  - 20-30: Caries in the dentin
  - >30: Radiographically detectable and clinically large caries.
- Several studies state that the specificity and sensitivity of DIAGNOdent is equal to radiographs



## 3D - Printers

### Dentures

- 3D-printed dentures are usually produced by the stereolithography (SLA) method. The 3D denture enables more efficient clinical adaptation which minimizes patient discomfort and potentially reduces long-term bone resorption
- Few studies have shown that color changes of 3D-printed denture resins were low compared to conventional heat polymerized PMMA



### Dental Models

- 3D printers work without tools, and users can print a finished product using a digital model. With advancements in DLP printers and photosensitive dental resins, study models can be directly printed from intraoral scanners in few steps
- The term 'accuracy' in 3D printing is used when both trueness and precision are achieved, according to ISO 5725-1:1994/Cor 1:1998



### Clear Teeth Aligners

- 3D printing offers highly precise clear aligners with soft edges, with a better fit, higher efficacy, and reproducibility compared to traditional
- 3D printed models minimize geometric inaccuracies occurring during impression collection. Photo-polymerization from clear resin has seen the most accuracy
- It has maximum load with a low displacement property and can deform elastically with reversibility



### Surgical guides

- A digital surgical guide was introduced to compensate for the inaccurate lab procedures, and difficulty during implant placement using traditional surgical guiding stent
- Patient-specific 3D guides help the surgeon minimize human error, improve intraoperative accuracy, and reduce surgical time and intraoperative X-ray exposure



## References

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