

## Introduction

Raman-microspectroscopy has the ability to detect compound-specific molecules since the Raman band positions are specific to particular chemical groups.<sup>1</sup> It is also an excellent technique to study the chemistry of interfaces because it doesn't require homogenization, analyzes each structure *in situ*, without destruction or preparation requirements and uses a high lateral resolution laser (approximately 1 $\mu$ m).<sup>2,3</sup>

The kinetic of the polymerization reaction greatly influences the performance and properties of the resin-based materials, as dental adhesive systems and this evolution can also be study by Raman-microspectroscopy.

## Objectives

To study the kinetic of the polymerization reaction of some adhesive systems with Raman-microspectroscopy.

## Results

Optibond FL and Scotchbond 1XT yielded a fast polymerization evolution, which stopped with the irradiation (no residual polymerization). (Figures 1A-1C,2A-2C)

The polymerization process of the Scotchbond Multi-Purpose continued after the irradiation, following a logarithmic shape. (Figure 3B)

EasyBond, showed two different behaviours; the polymerization continued after the irradiation and had an exponential growth shape during more or less 75sec (for all the irradiation times). After that, there was no evolution. (Figure 4A,4B)

Scotchbond 1XT was the only adhesive that achieved very low conversion degree for irradiation periods below 5sec. (Figures 2A,2B)

## Materials and Methods

Raman spectrophotometer Xplora (Horiba Jobin-Yvon), with a 638nm laser diode was used;

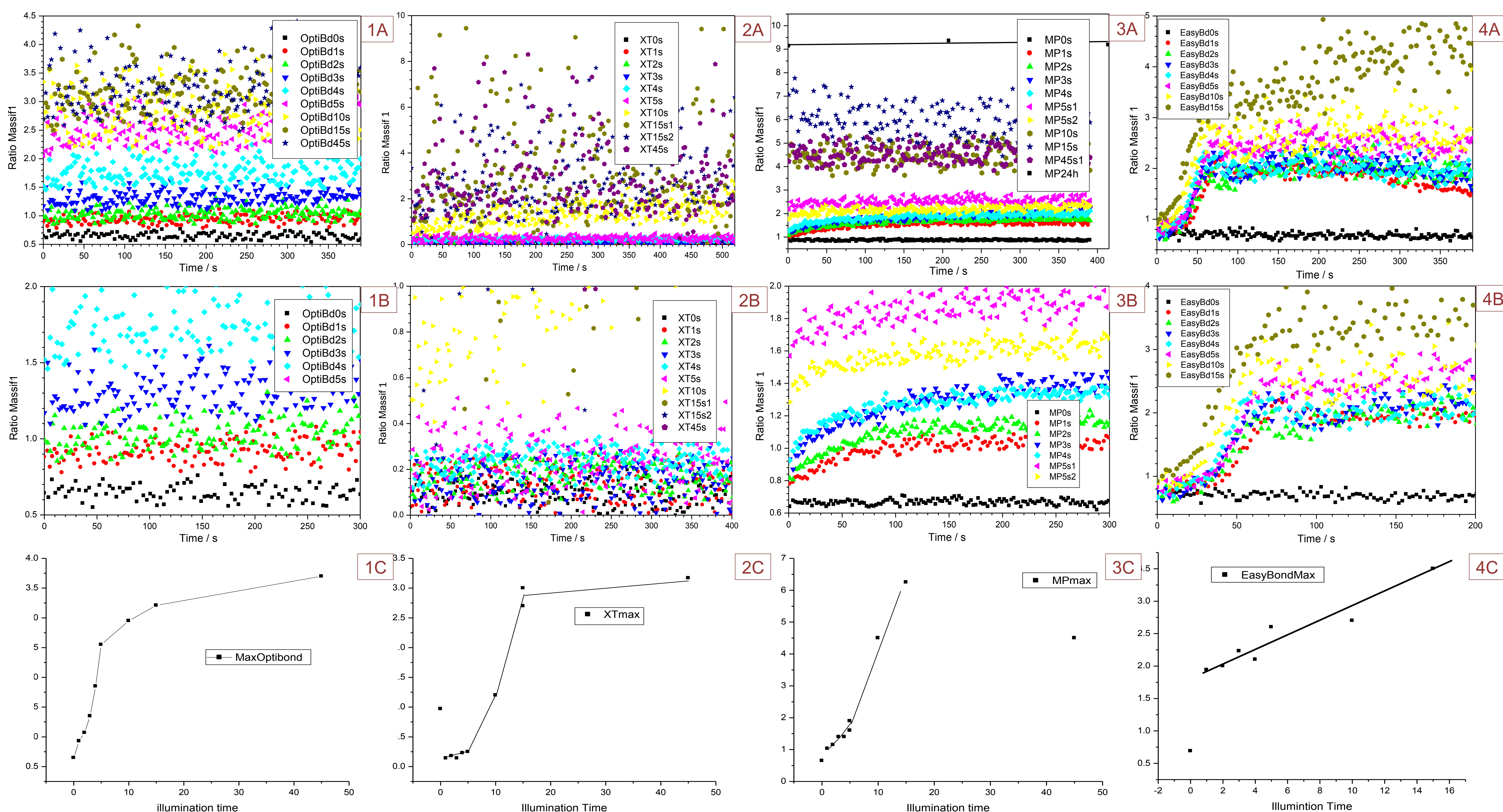
Spectra were obtained in the spectral range 350-2000 $\text{cm}^{-1}$ , with a diffraction grating of 1200 line/mm (spectral resolution given by the software LabSpec V5.78:7 $\text{cm}^{-1}$ );

A drop of each adhesive [OptiBond FL (Kerr), Scotchbond Multi-Purpose (3M-ESPE), Scotchbond 1XT (3M-ESPE) and EasyBond (3M-ESPE)] was placed on a microscope glass slide and irradiated with a LED photo-curing unit [bluephase 20i (Ivoclar-vivadent)], fixed at 1cm from the drop;

Irradiation times were: 0sec, 1sec, 2sec, 3sec, 4sec, 5sec, 10sec, 15sec and 45sec;

Spectra were acquired immediately after irradiation and every 2sec for a total of 500sec;

An ultimate spectrum was done 24h after 45sec of irradiation in order to establish the maximum conversion degree.



Figures 1A-4C - Evolution of the ratio  $I_{1610}/I_{1640}$  of the integrated intensity of two peaks, at 1610 $\text{cm}^{-1}$  and 1640 $\text{cm}^{-1}$  for the adhesives studied. **A** in the range 0, 500sec; **B** magnification in the range 0, 200s; **C** evolution of the conversion degree with the illumination time.

## Conclusions

- The curing kinetics was different for each adhesive system tested.
- All the adhesives reached the maximum conversion degree after 15sec of irradiation with a distance of 1 cm between the curing light and the sample.

## References

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