p-15 Mechanical properties and microleakage of composite resin materials cured by variable light intensities

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Ⅰ. Objectives

Curing technique with variable light intensities was known to have it's unique characteristics. This study was done to evaluate if there are any advantages over conventional continuous curing technique and to find out the differences between soft-start technique and ramping technique, through comparing material's mechanical properties and microleakage according to various curing conditions.

Ⅱ. Material and Methods

Mechanical properties of microhardness and compressive strength were evaluated in two hybrid composites; conventional hybrid type DenFil (VERICOM Co., Anyang, Korea) / micro matrix hybrid type Esthet X (Dentsply Caulk, Milford, DE, U.S.A.).

Curing was done for 40 seconds in two ways of 2 step soft-start technique and 5 step rampinf technique. Three kinds of light intensities of 50, 100, 200 mW/cm^2 were initially used for 10, 20, 30 seconds each and the maximum intensity of 600 mW/cm^2 was used for the rest of curing time in a soft-start curing technique. In a ramping technique, curing was started with the same initial intensities and the light intensity was increased 5 times with the same rate to the maximum intensity of 600 mW/cm^2.

After determining conditions that showed no different mechanical properties with conventional technique, Class V restorations were made with Esthet X composite.

Microleakage was evaluated in two ways of 1% methylene dye penetration and of maximum marginal gap estimation through SEM observation.

Ⅲ. Results

1. Except the conditions that start curing with an initial light intensity of 50 mW/cm^2, several curing conditions of variable light intensities resulted in the similar mechanical properties with a conventional continuous curing technique, even if there was a little difference between composite materials.
2. Two composites showed the highest hardness value with a conventional technique, the next high value with a ramping technique and the lowest value with a soft-start technique. However, they showed the highest compressive strength with a ramping technique, the next high value with a conventional technique and the lowest value with a soft-start technique. Conclusively, conventional and ramping techniques were better than soft-start technique in a mechanical properties.
3. Soft-start group that started curing with an initial light intensity of 100 mW/cm^2 for 10 seconds showed the least dye penetration, this was significantly different ($p=0.011$) from that of ramping group which started curing with 200 mW/cm^2 for 10 seconds. There was, however, no difference among other groups. Soft-start group that started curing with an initial light intensity of 200 mW/cm^2 for 10 seconds showed the smallest marginal gap, if there was no difference among groups.
4. Soft-start technique resulted in less dye-penetrable margin than conventional technique($p=0.014$) and ramping technique($p=0.002$). This technique, however, showed better marginal gap than conventional and ramping techniques without any significant difference.
5. There was a very low relationship($p=0.157$) between the methods of dye penetration and marginal gap determination through SEM evaluation.

Ⅳ. Conclusion

From the results of this study, it was revealed that ramping technique would be better than conventional technique in mechanical properties, however, soft-start technique might have advantage over conventional one in microleakage. This was coincident with the idea that it was very difficult to get both superior mechanical properties and microleakage.

It was concluded that much endeavor should be made to find out the curing conditions, which have advantages of both aspects or to solve these kinds of problems through an novel idea of polymerization.